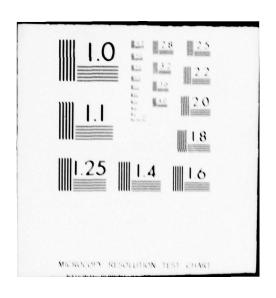
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INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFIGURATION

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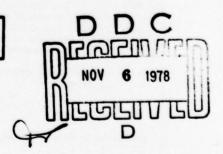
VOLUME II-E - Harmonic Analyses of Airframe Surface Pressure Data, Runs 15-22, Mid Section

Philip F. Sheridan
Boeing Vertol Company
P.O. Box 16858
Philadelphia, Pa. 19042

September 1978

Final Report for Period March 1977 - February 1978

Approved for public release; distribution unlimited.



Prepared for

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APPLIED TECHNOLOGY LABORATORY

U. S. ARMY RESEARCH AND TECHNOLOGY LABORATORIES (AVRADCOM)

Fort Eustis, Va. 23604

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APPLIED TECHNOLOGY LABORATORY POSITION STATEMENT

In 1975 a wind tunnel test program was conducted in the Boeing-Vertol 20-foot V/STOL Wind Tunnel on a 1/5th-scale UTTAS model to investigate and find solutions for several aerodynamic problems encountered during the UTTAS flight-testing. Specifically, these tests focused upon (a) the structure of the hub/rotor wake in the vicinity of the empennage, (b) the formulation of the ground vortex and its relation to hub loads and fuselage loads during transition, and (c) the occurrence of vibratory air pressures from the blade passing over the fuselage. Only portions of the above-mentioned wind tunnel test data were reduced and analyzed in addressing the flight-test problems of the UTTAS aircraft.

Under Contract DAAJ02-77-C-0020, Boeing-Vertol completed analyses on the data to understand more completely the aerodynamic interactions that are involved and to formulate instructions for the guidance of designers in these respects. The results of these studies are applicable to all existing and future single-rotor/tail rotor helicopters. The data have been segregated according to aerodynamic interactions and associated phenomena/problem areas. From this body of knowledge, a generalized set of design guidelines meaningful to the single-rotor helicopter design concept formulation were developed and are included in these reports.

Mr. Robert P. Smith of the Aeronautical Technology Division, Aeromechanics Technical Area, served as project engineer for this effort.

DISCLAIMERS

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

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The entire report describing the investigation of INTERACTIONAL AERODYNAMICS OF THE SINGLE-ROTOR HELICOPTER CONFIGURATION comprises eight numbered volumes bound as 33 separate documents. The complete list of these documents is as follows:

Volume I, Final Report

Volume II, Harmonic Analyses of Airframe Surface Pressure Data

- A Runs 7-14, Forward Section
- B Runs 7-14, Mid Section
- C Runs 7-14. Aft Section
- D Runs 15-22, Forward Section
- E Runs 15-22, Mid Section
- F Runs 15-22, Aft Section
- G Runs 23-33, Forward Section
- H Runs 23-33, Mid Section
- I Runs 23-33, Aft Section

Volume III, Flow Angle and Velocity Wake Profiles in Low-Frequency Band

- A Basic Investigations and Hubcap Variations
- B Air Ejector Systems and Other Devices

Volume IV, One-Third Octave Band Spectrograms of Wake Split-Film Data

- A Buildup to Baseline
- B Basic Configuration Wake Explorations
- C Solid Hubcaps
- D Open Hubcaps
- E Air Ejectors
- F Air Ejectors With Hubcaps; Wings
- G Fairings and Surface Devices

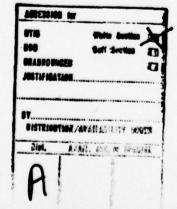
Volume V, Harmonic Analyses of Hub Wake

Volume VI, One-Third Octave Band Spectrograms of Wake Single Film Data

- A Buildup to Baseline
- B Basic Configuration Wake Exploration
- C Hubcaps and Air Ejectors

Volume VII, Frequency Analyses of Wake Split-Film Data

- A Buildup to Baseline
- B Basic Configuration Wake Explorations
- C Solid Hubcaps





D - Open Hubcaps

E - Air Ejectors

F - Air Ejectors With Hubcaps; Wings

G - Fairings and Surface Devices

Volume VIII, Frequency Analyses of Wake Single Film Data

A - Buildup to Baseline

B - Basic Configuration Wake Exploration

C - Hubcaps and Air Ejectors

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INTRODUCTION

Volume II summarizes the harmonic analyses of the airframe surface pressures measured at 53 locations on the fuselage, nacelles, and empennage of the model. These values are presented in nine volumes resulting from the following division of runs and pressures.

Volume	Runs	Pressure Section
II-A	7-14	Forward
II-B		Mid
II-C		Aft
II-D	15-22	Forward
II-E		Mid
II-F		Aft
II-G	23-53	Forward
II-H		Mid
II-I		Aft

A computer printout sheet is provided for each pressure transducer for every run. The steady and ten harmonic components are given in pounds per square inch. The resultant and its phase angle are shown as well as the sine and cosine. A machine plotted time history with points every three degrees is offered for reference.

The parameters of any run may be found in the list of Test Runs, (Table 1), a copy of which appears in each volume.

The designation (PS number) of the pressure sensors within each section are shown below.

Forward Section	Mid Section	Aft Section
004.1	045.1	081.1
013.1	045.2	081.2
013.2	047.1	081.3
013.3	047.2	099.1
015.1	048.1	099.2
017.1	048.2	099.3
017.2	048.3	107.1
017.3	052.1	107.2
017.4	052.2	107.3
017.5	056.1	107.4
017.6	056.2	107.5
017.7	056.3	107.6
023.1	057.1	112.1
023.2	057.2	112.2
023.3	071.1	117.1
023.4	072.1	117.2
023.5	072.2	117.2
026.1	0/2.2	
020.1		

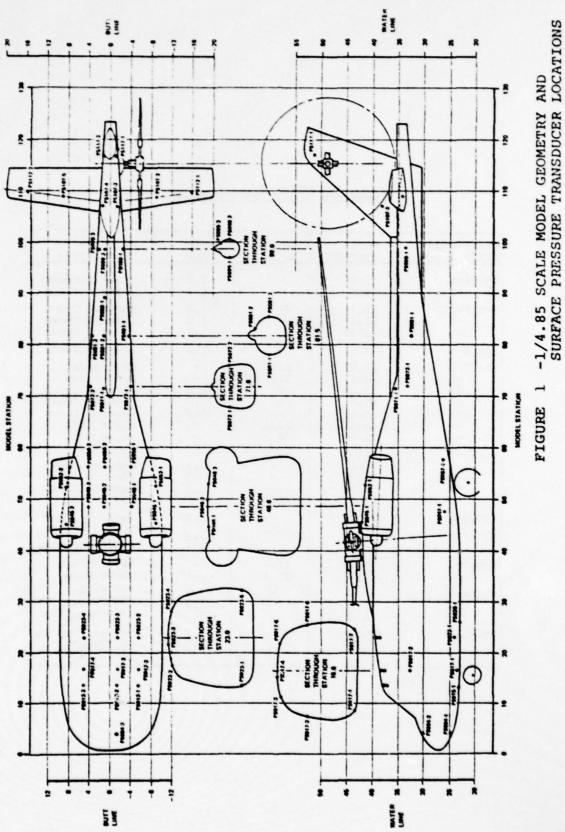
The location of each transducer is shown in the scaled model drawing (Figure 1) and the listing of the transducer locations (Table 2).

The great majority of the pressure data points permitted usable harmonic analysis. Occasionally the computer program would skip a case with too many points beyond the valid voltage bandwidth of the measurement system. This is noted by the words "BANDEDGE". There are also a few cases where a very flat variation indicates an inoperative transducer.

	TABLE LIST OF TE	TABLE 1 OF TEST RUNS	4S					
	MEASUREMENT OF VIBRATORY		SURFACE PRE	PRESSURES				
RUN	COMPTGIIBATTON	VTUN	RPM	DISK	ANG	MODEL	MR HT.	TAIL
NO.		KNOTS	MR/TR	rbg.	• 5	•	h/d	ROTOR
1	$K_{ m l}/(a)$ Level flight baseline	09	1433/	80	2.2	-6.5	8	ď
	" /(b) Max. gross weight level flt. baseline			10	3.3	•		
8	" /(a) Repeat 7(a)			80	2.2	•	•	
	" /(b) Increase speed to maximum	160	•		-3.5	-2.0	•	
6	K2/Repeat high speed baseline with TR off		1433/0	=		=		Off
10	" /Max. climb at low speed	09			-26.5	-15		•
11	" /(a) Repeat 10; T.P. 2,3,4,5	•			-26.5	-15		
	" /(b) Repeat 7(a) with TR off, T.P. 6,7,8,9			•	2.2	-6.5		
12	" /(a) Repeat 7(b) with TR off	•	•	10	3.3	-6.5		•
	" /(b) Max. G.W. at max. speed with TR off	160			-2.0	-2.0		
13	$K_2+S_1/Check$ longitudinal strakes			8	-3.5	-2.0	•	
14	K ₂ +S ₂ /Check lateral strakes			u				•

ROTOR TAIL Off = = = = = = h/d 8 = = = = = -2.0 = 0 = = = = = • ANGLES MODEL -3.5 -3.5 21 = = = = : MEASUREMENT OF VIBRATORY SURFACE PRESSURES DISK LDG. psf œ : = : = = = MR/TR 1433/0 RPM = = = = = LIST OF TEST RUNS TABLE 1. CONTINUED KNOTS VTUN 160 09 160 = = = = = = K2+VG1/Effect of vortex generators K2+S3/Effect of lower longitudinal K4+S3/Lower strakes added to rais-ed rotor K5+S3/Lower strakes with rotor in K2/Autorotation at maximum speed K₃/Effect of 45° tapered blade CONFIGURATION/CONDITION K4/Rotor raised 2.5 inches K₅/Rotor raised 5.0 inches on forward crown highest position K₂/Autorotation root cutout strakes NO. 15 16 18 17 19 20 21 22 23

TAIL ROTOR Off = = = = = = = = = MR HT. h/d 8 = = = = = = = = = F6.5 -3.2 -2.3 -2.2 -2.1 -1.9 MODEL • 0 = = = . 2.2 0.2 9.0-5.3 5.0 3.5 -1.6 -2.7 -3.5 4.4 MEASUREMENT OF VIBRATORY SURFACE PRESSURES DISK LDG. psf œ = = = = = = = = RPM MR/TR 1433/0 = = = = = = = = = LIST OF TEST RUNS Vrun KNOTS 20 30 50 09 80 100 40 120 140 160 CONFIGURATION/CONDITION K2/Level flight speed sweep = = = = = = = = : = NO. 24 56 25 27 28 29 30 33 32 31

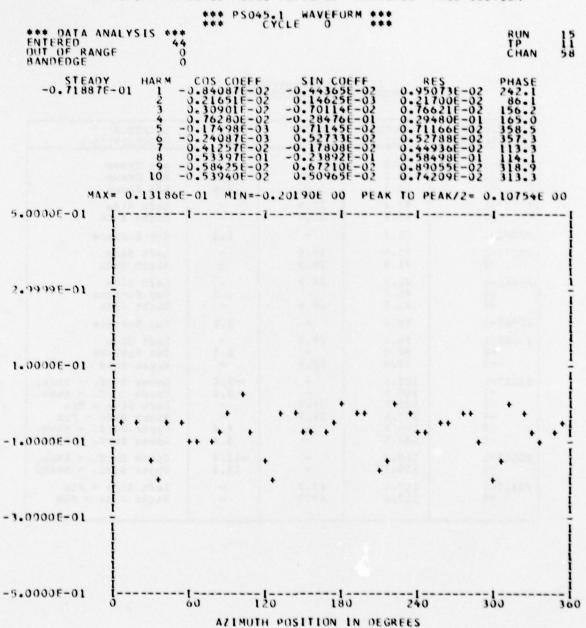


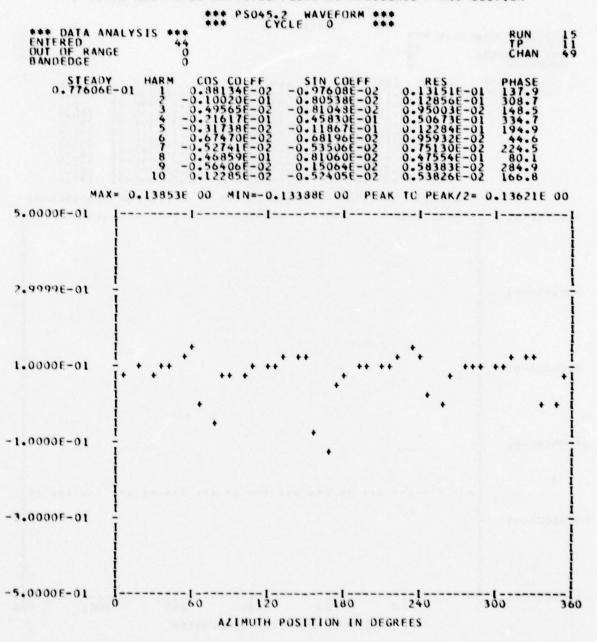
PRESSURE TRANSDUCER LOCATIONS

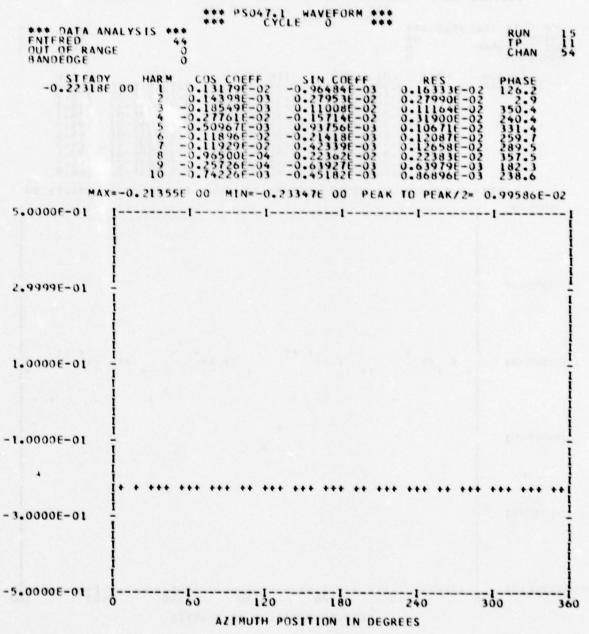
TRANSDUCER DESIGNATION	MODEL STATION	WATER LINE	BUTT	LOCATION DESCRIPTION
PS004-1 -2	4.0	:	-1.2 -1.2	Lower Surface Upper Surface
PS013-1 -2 -3	13.4 13.4 13.4	:	-5.3 -1.2 5.2	Forward Crown Forward Crown Forward Crown
PS015-1	13.4	-	-1.2	Lower Surface
PS017-1 -2 -3 -4 -5 -6 -7	16.6 16.6 16.6 16.6 16.6 16.6	24.2 33.4 - - 33.4 24.2	-5.3 -1.2 5.2	Left Side Left Side Forward Crown Forward Crown Forward Crown Right Side Right Side
PS023-1 -2 -3 -4 -5	23.0 23.0 23.0 23.0 23.0	25.9	-5.3 -1.2 5.2	Left Side Forward Crown Forward Crown Forward Crown Right Side
PS026-1	26.0	-	-1.2	Under Surface
PS045-1 -2	45.4 45.4	:	-8.7 8.7	Top of Nacelle
PS047-1 -2	47.4	26.6 26.6	:	Left Side Right Side
PS048-1 -2 -3	48.6 48.6 48.6	:	-3.9 1.2 4.4	Aft Crown Aft Crown Aft Crown
PS052-1 -2	52.6 52.6	:	-8.7 8.7	Top of Nacelle

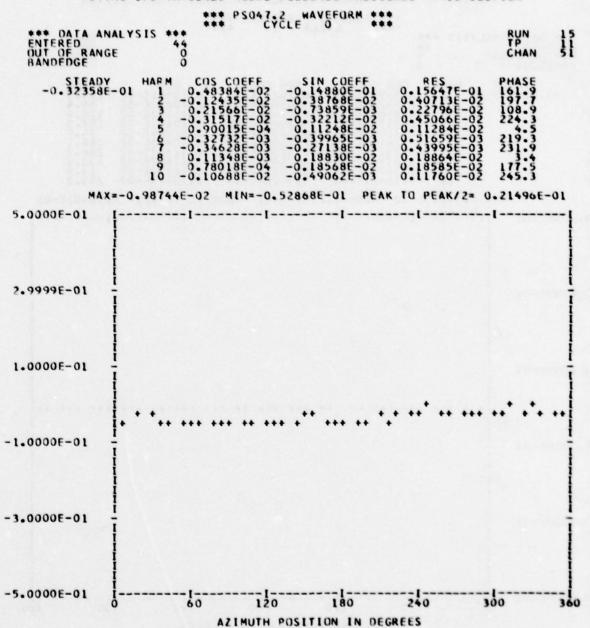
TABLE 2 (CONTINUED)
PRESSURE TRANSDUCER LOCATIONS

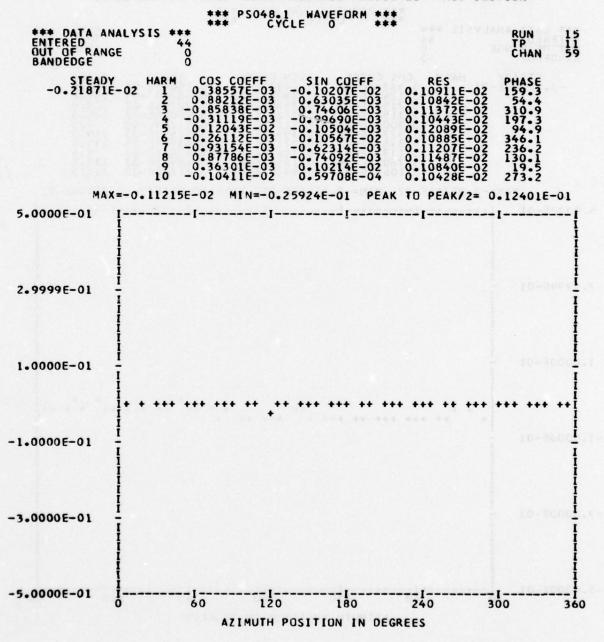
TRANSDUCER DESIGNATION	MODEL STATION	WATER LINE	BUTT	LOCATION DESCRIPTION
PS056-1 -2 -3	56.2 56.2 56.2	:	-3.9 1.2 4.4	Aft Crown Aft Crown Aft Crown
PS057-1 -2	57.4 57.4	27.0 27.0	:	Left Side Right Side
PS071-1	71.4	-	1.2	Top Surface
PS072-1 -2	71.6	28.9 28.9	:	Left Side Right Side
PS081-1 -2 -3	81.5 81.5 81.5	28.9	1.2	Left Side Top Surface Right Side
P3089-1	89.4	-	1.2	Top Surface
PS099-1 -2 -3	99.0 99.0 99.0	28.9	1.2	Left Side Top Surface Right Side
PS107-1 -2 -3 -4 -5 -6	109.5 109.5 109.5 109.5 109.5 109.5	38.7 38.7	-8.6 -8.6 -8.6 8.6	Lower Surf Stab Upper Surf Stab Laft Side - Fin Right Side - Fin Upper Surf Stab Lower Surf Stab
PS112-1 -2	110.3	:	-15.9 15.9	Upper Surf Stab. Upper Surf Stab.
PS117-1 -2	117.0	47.7	:	Left Side - Fin Right Side - Fin



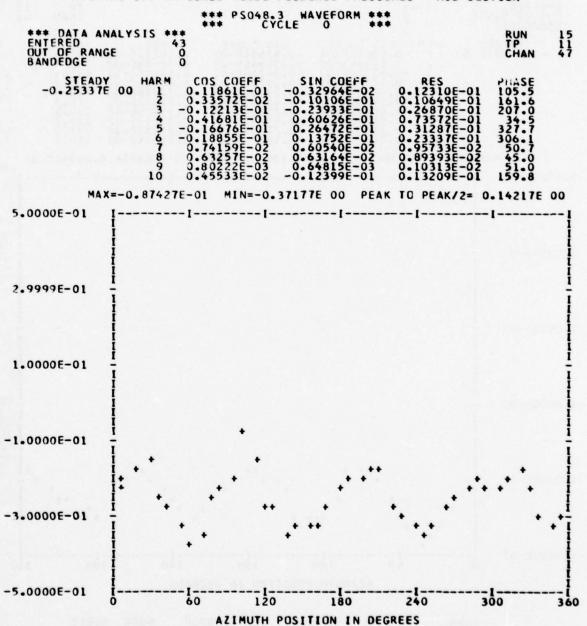


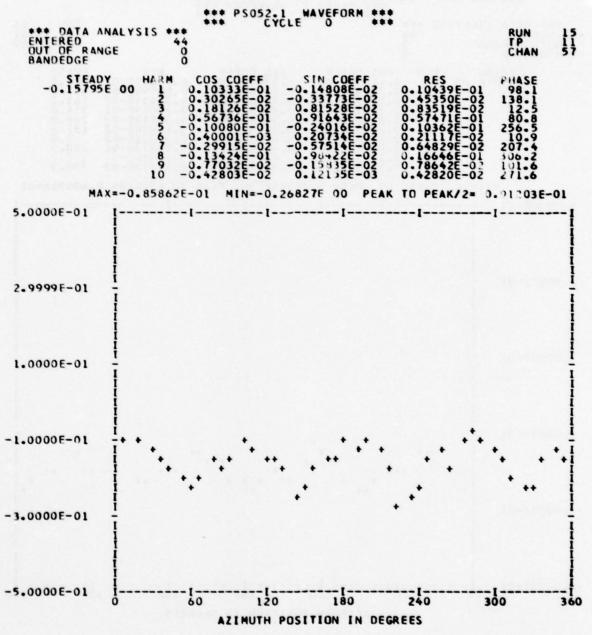


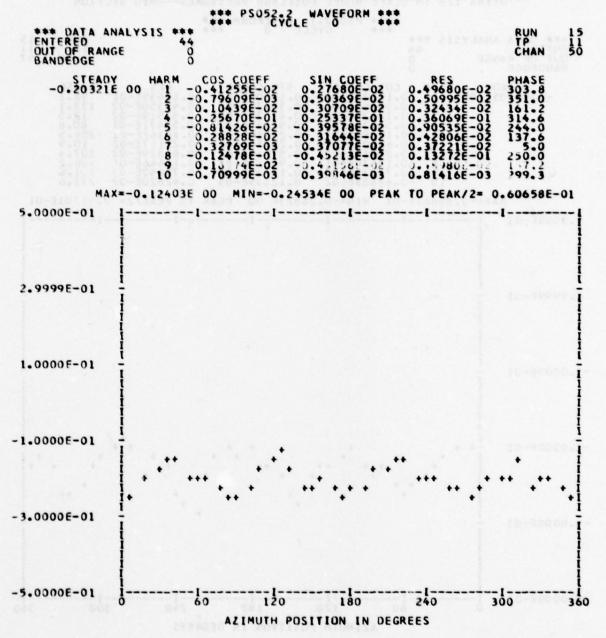


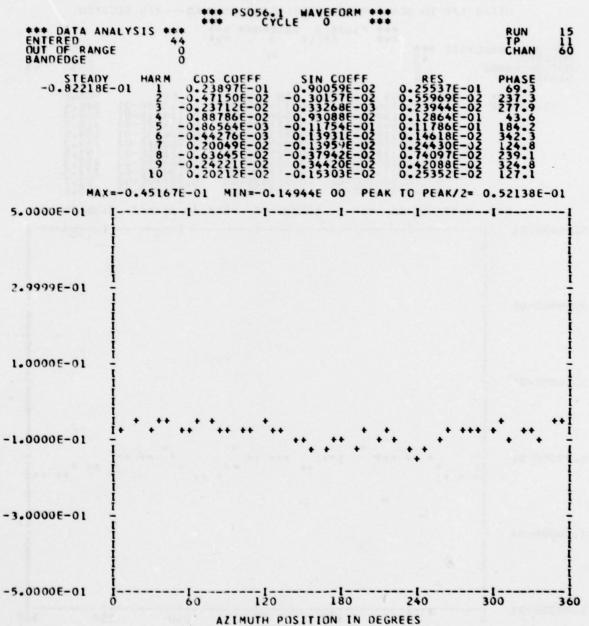


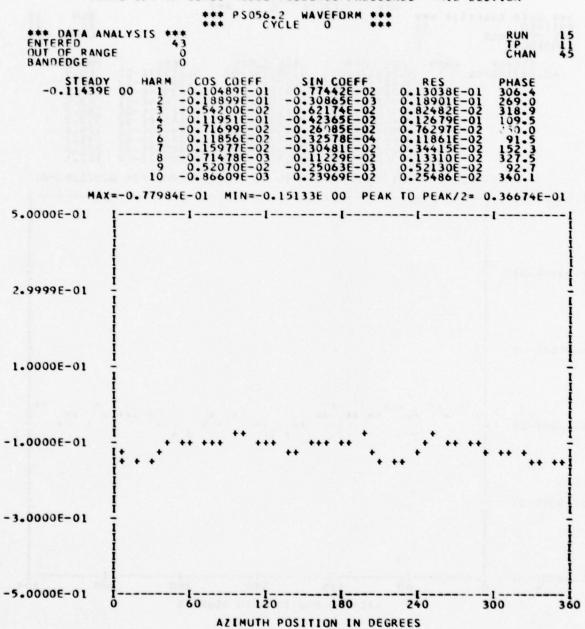
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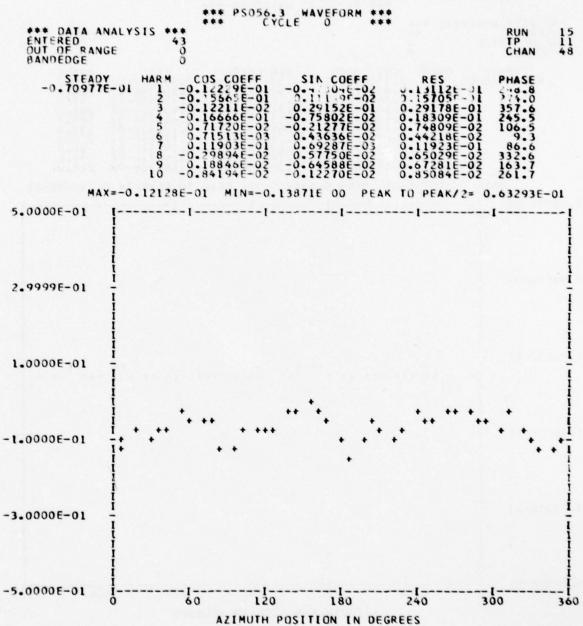


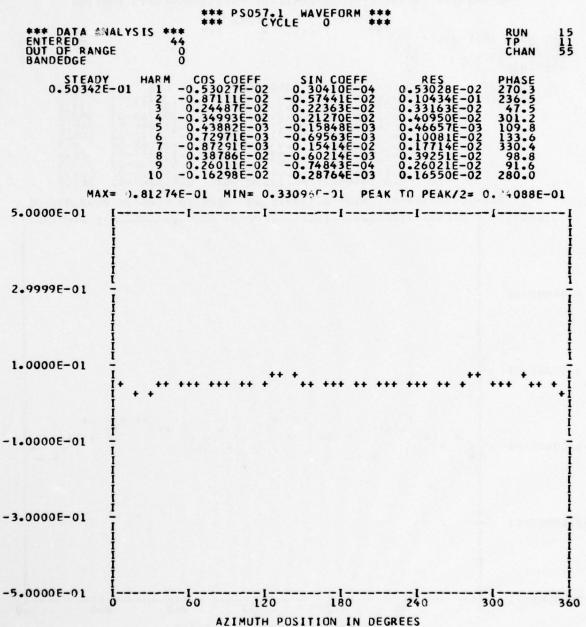


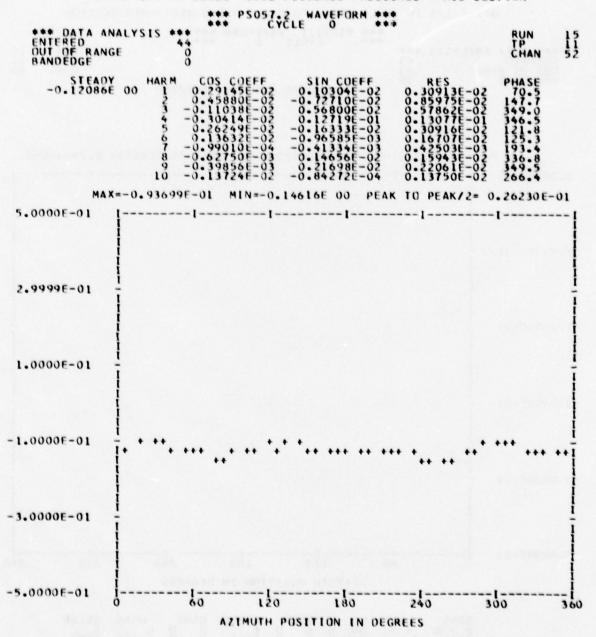




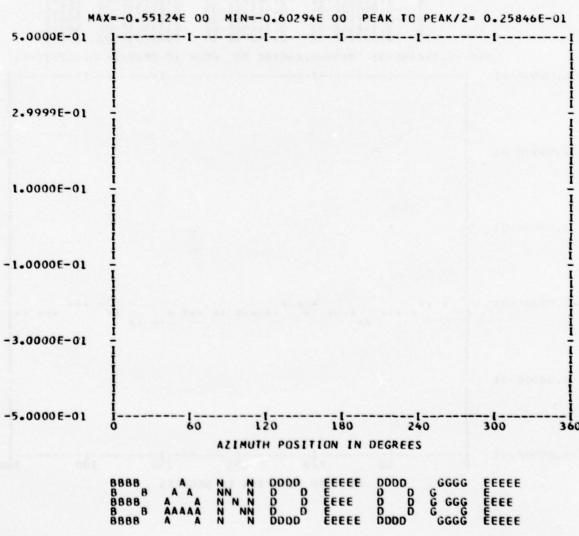


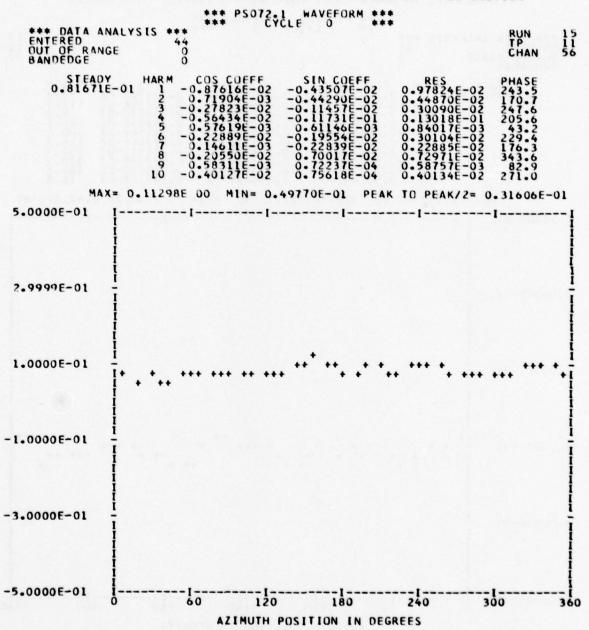


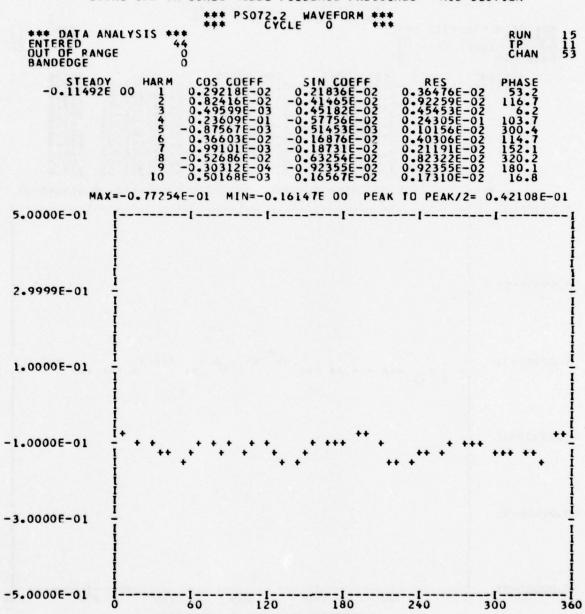




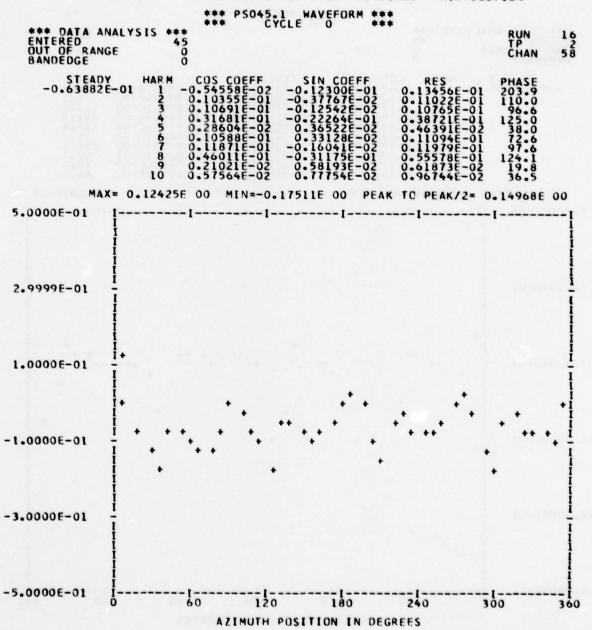
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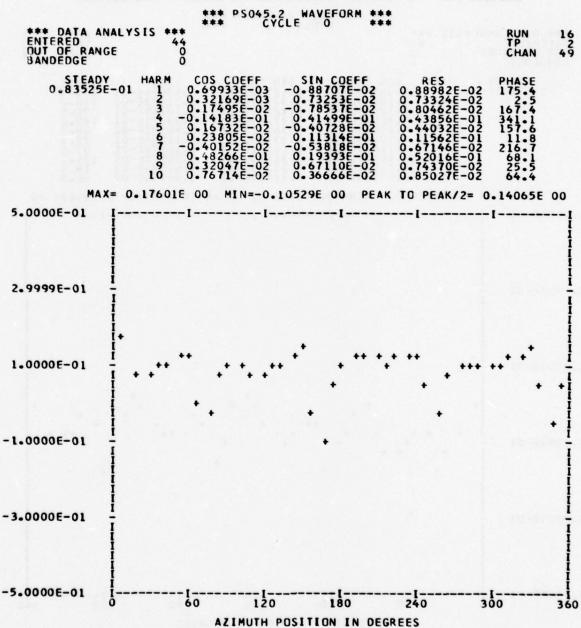


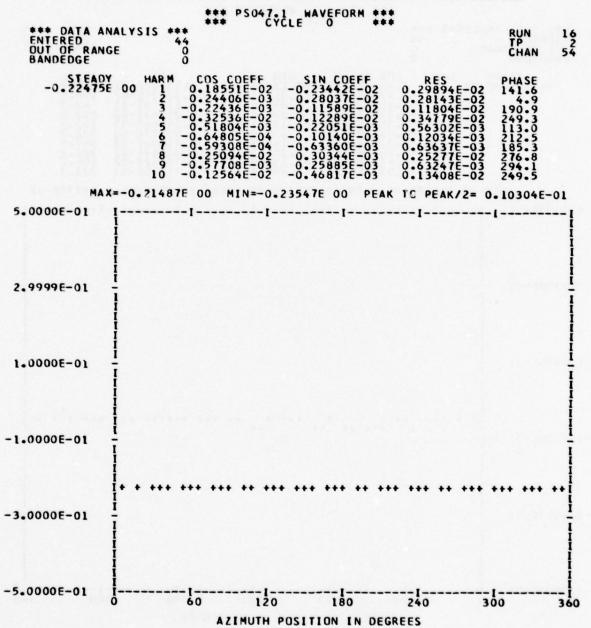


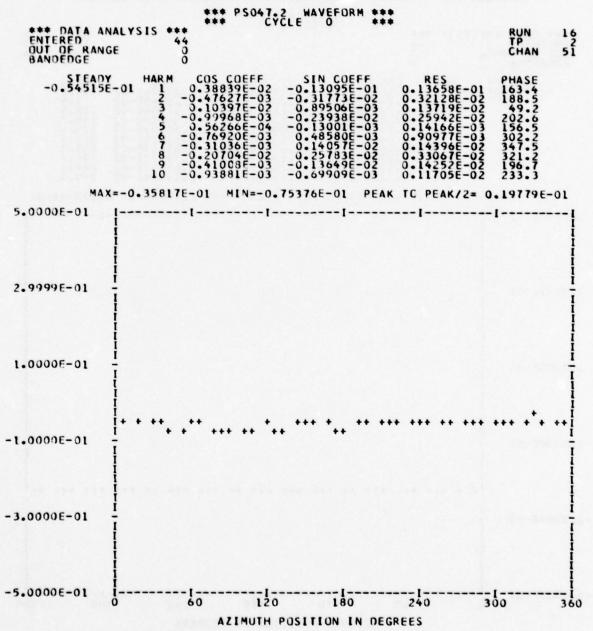


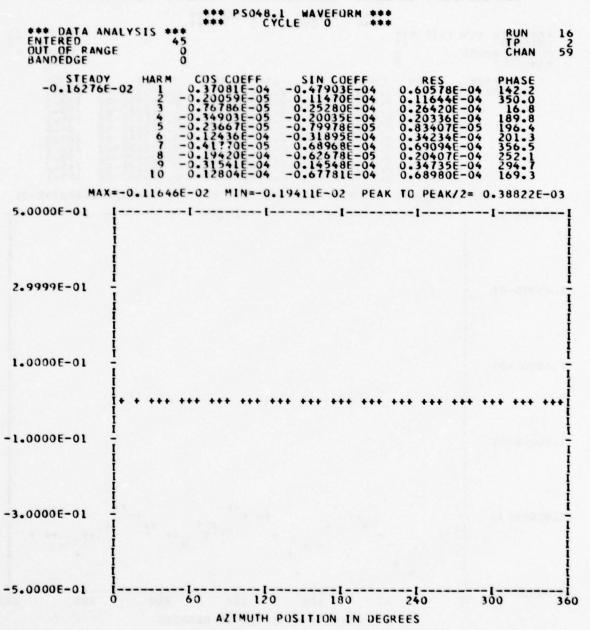
AZIMUTH POSITION IN DEGREES



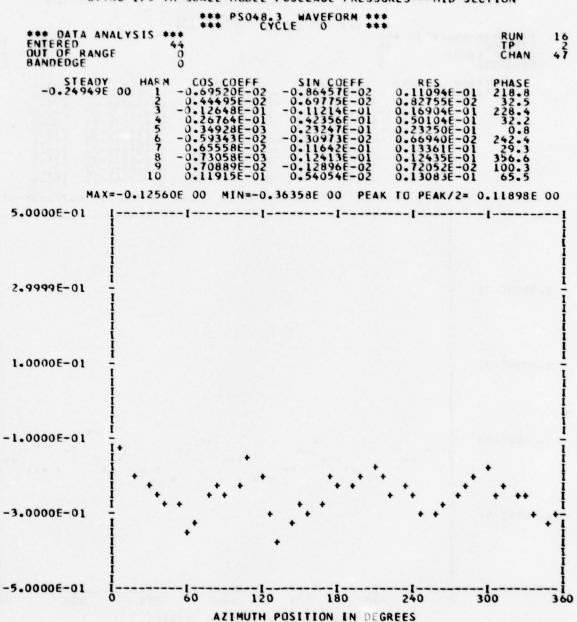


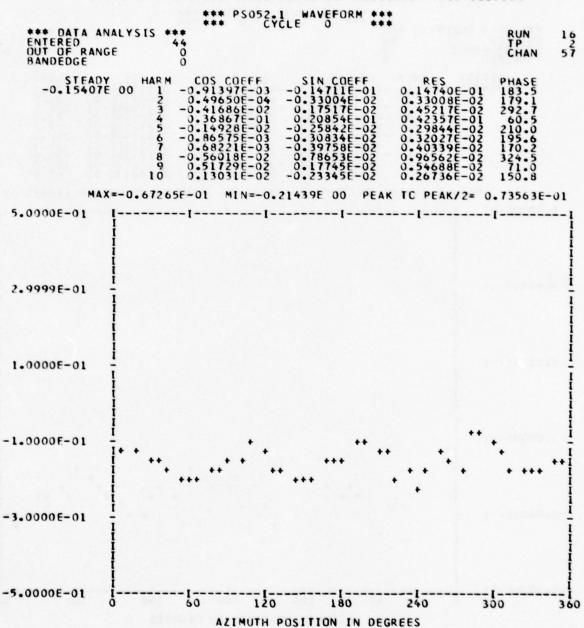


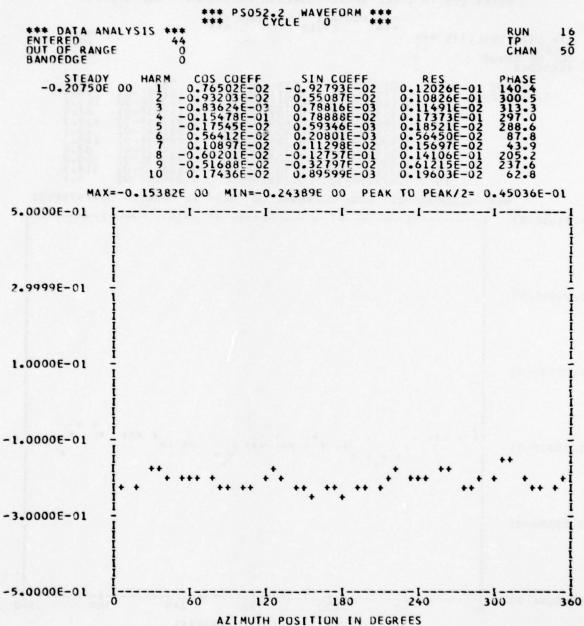


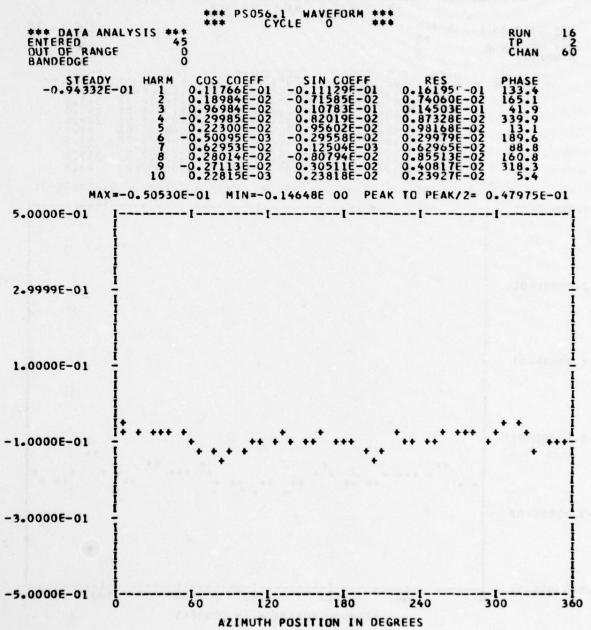


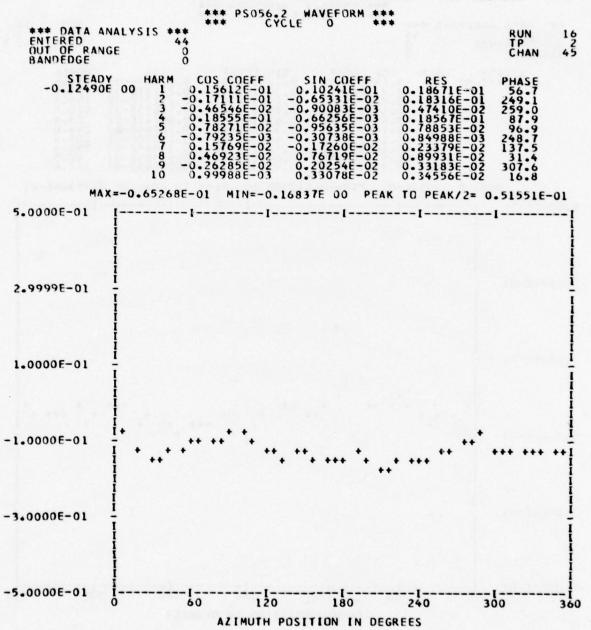
*** PS048.2 WAVEFORM *** *** CYCLE 0 ***		
*** DATA ANALYSIS *** ENTERED 45 OUT OF RANGE 0 BANDEDGE 0	RUN TP CHAN	61
STEADY HARM COS COEFF SIN COEFF 0.20527E-01 0.34027E 00 1 -0.16917E-01 -0.11626E-01 0.20527E-01 2 0.64878E-04 -0.24086E-02 0.24095E-02 3 -0.25633E-02 -0.10905E-01 0.11202E-01 4 0.31420E-01 -0.45964E-01 0.55677E-01 5 0.78083E-02 0.46100E-03 0.78219E-02 6 -0.49230E-02 0.16618E-02 0.51959E-02 7 0.64253E-02 -0.24772E-02 0.68863E-02 7 0.64253E-02 -0.13100E-02 0.90449E-02 9 -0.34718E-02 -0.16034E-02 0.30636E-02 10 0.78559F-03 -0.29612E-02 0.30636E-02	PHASE 235.5 178.4 193.2 145.6 86.6 288.6 111.0 98.3 245.2	
MAX=-0.26928E 00 MIN=-0.44503E 00 PEAK TO PEAK/2= 0.	.87873E-	-01
2.9999E-01	n-nee	
1.0000E-01		- I
-1.0000E-01		- I - I - I - I - I - I
-3.0000E-01	. •••	
-5.0000E-01	00	360

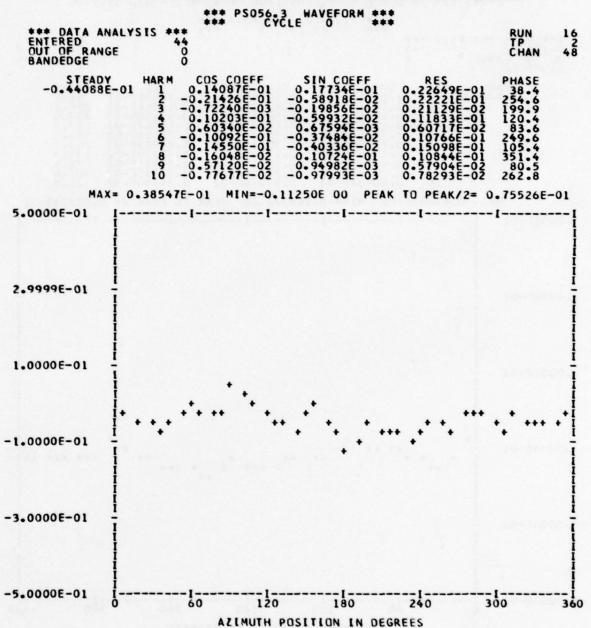


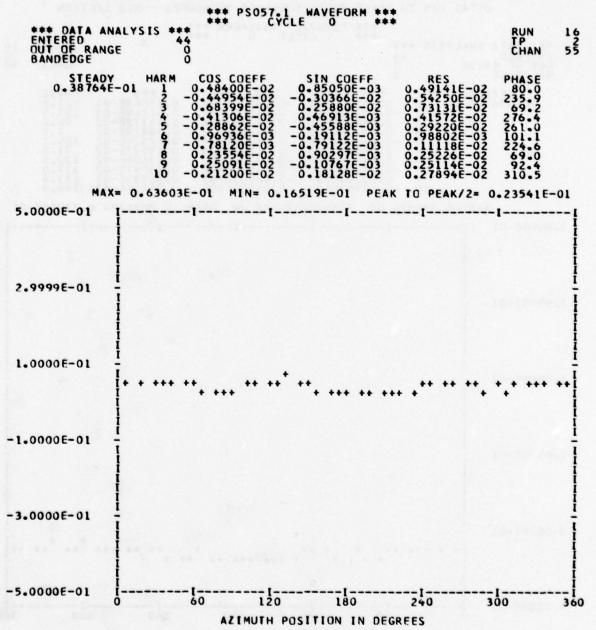


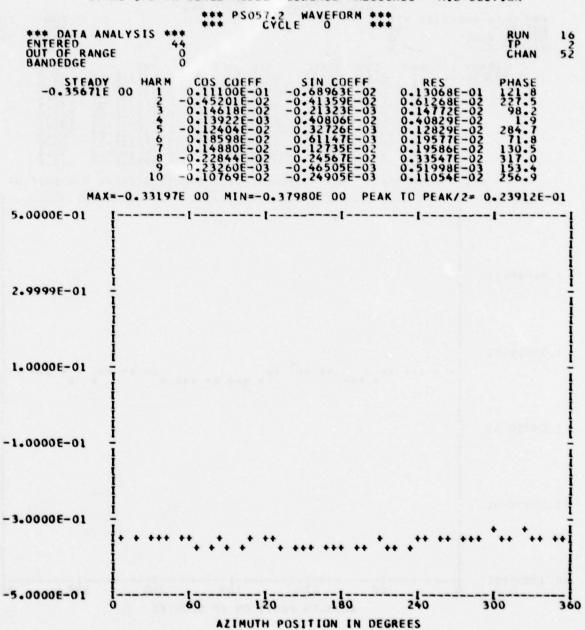


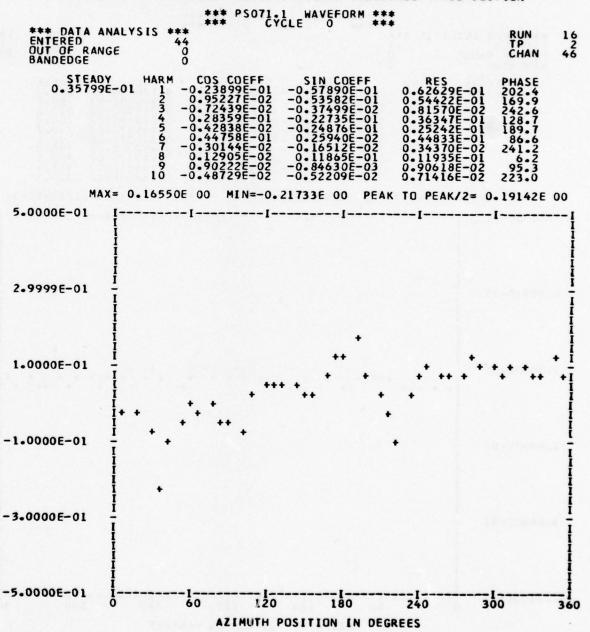


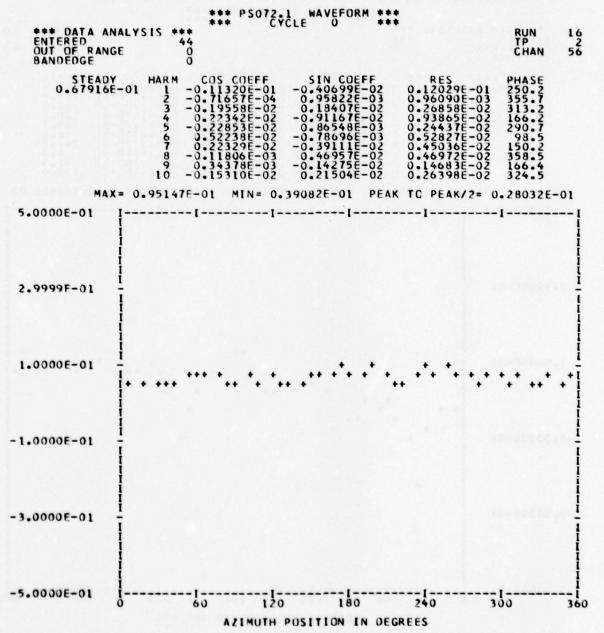


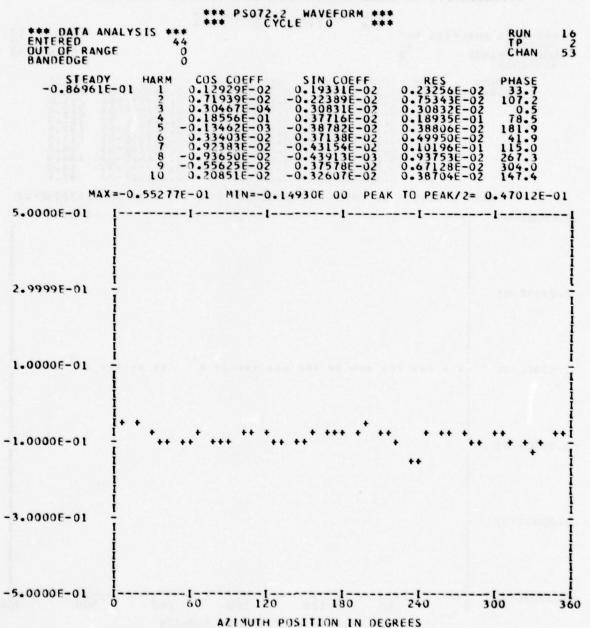




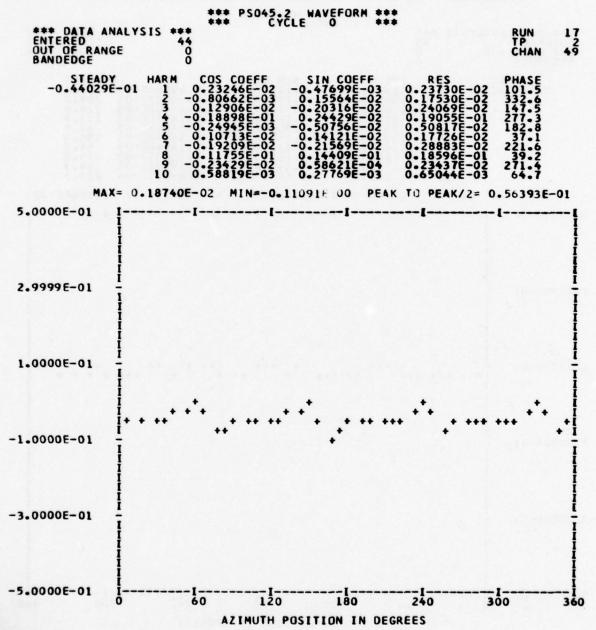


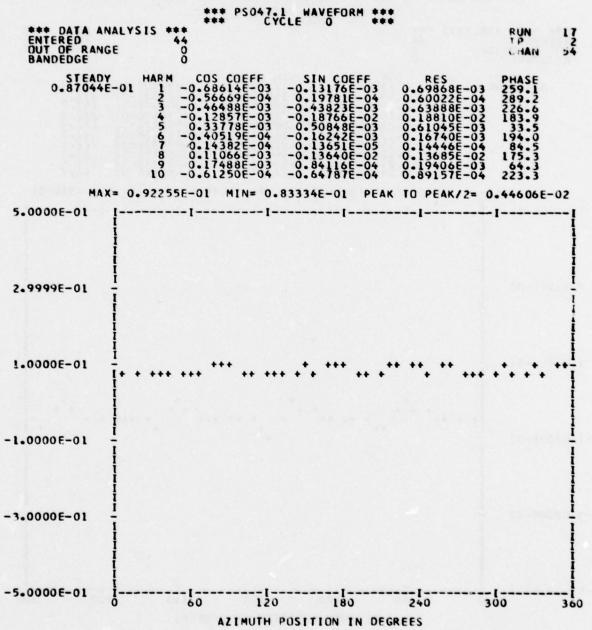


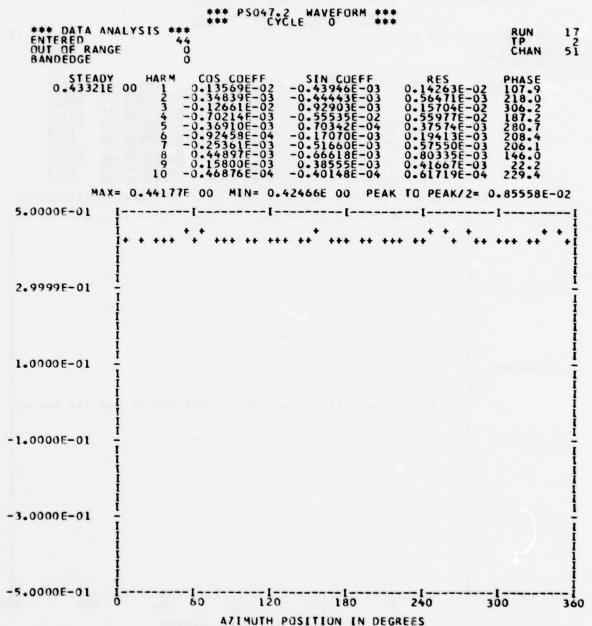


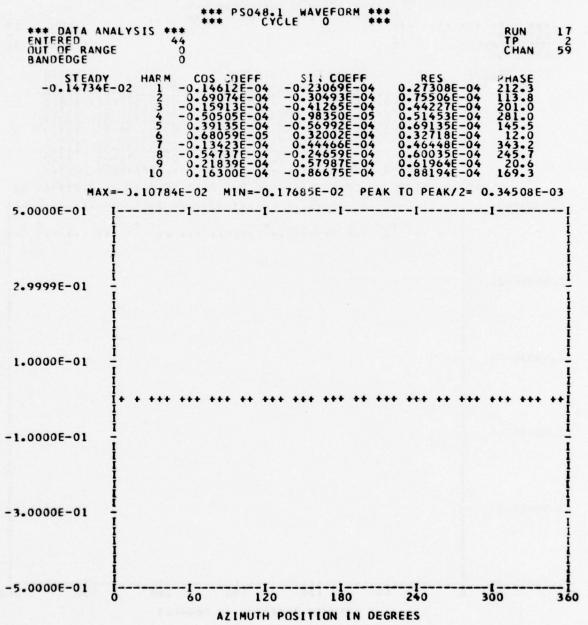


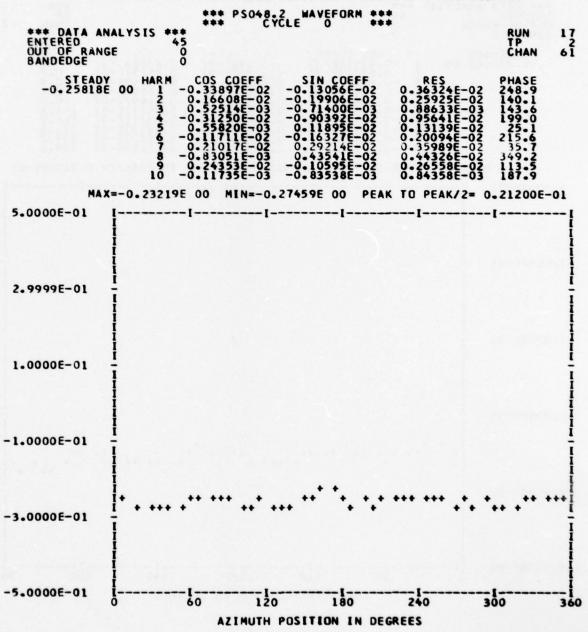
*** PS045.1 WAVEFORM *** CYCLE 0 ***		
*** DATA ANALYSIS *** ENTERED 44 OUT OF RANGE 0 BANDEDGE 0	RUN TP CHAN	17 2 58
STEADY HARM COS COEFF SIN COEFF 0.10946E 00 1 -0.80030E-03 -0.37456E-03 0.88361E-03 2 -0.56983E-03 0.14917E-03 0.58903E-03 3 -0.34226E-03 -0.57818E-03 0.67189E-03 4 -0.11719E-02 0.12992E-02 0.17497E-02 5 0.21276E-03 -0.41043E-03 0.46230E-03 6 -0.12174E-03 -0.19861E-03 0.23295E-03 7 0.44882E-03 0.27754E-03 0.52770E-03 8 -0.10029E-03 -0.63879E-03 0.52770E-03 9 0.88952E-04 0.35665E-03 0.36758E-03 0.10945E-03 0.18135E-03 0.21182E-03	PHASE 244.9 284.6 210.6 317.5 211.5 58.9 14.0 31.1	
MAX= 0.11497E 00 MIN= 0.10653E 00 PEAK TO PEAK/2= 0		02
2.9999E-01		
-1.0000E-01		
-3.0000E-01		
-5.0000E-01 IIIIIII	00	i 360
AZIMUTH POSITION IN DEGREES		

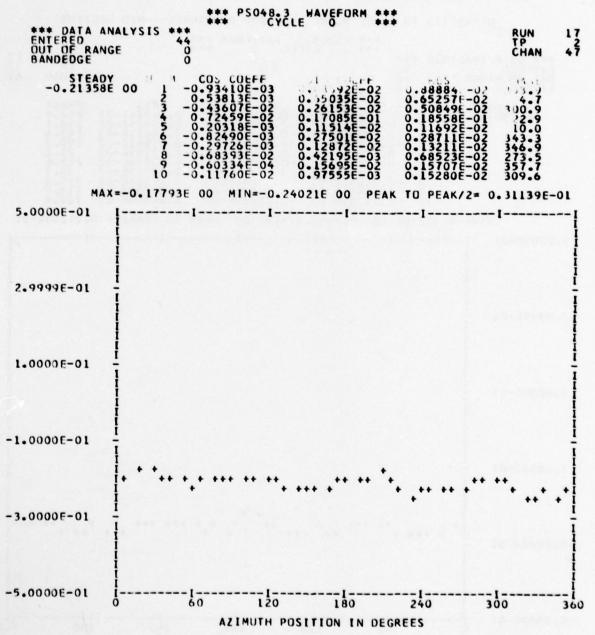


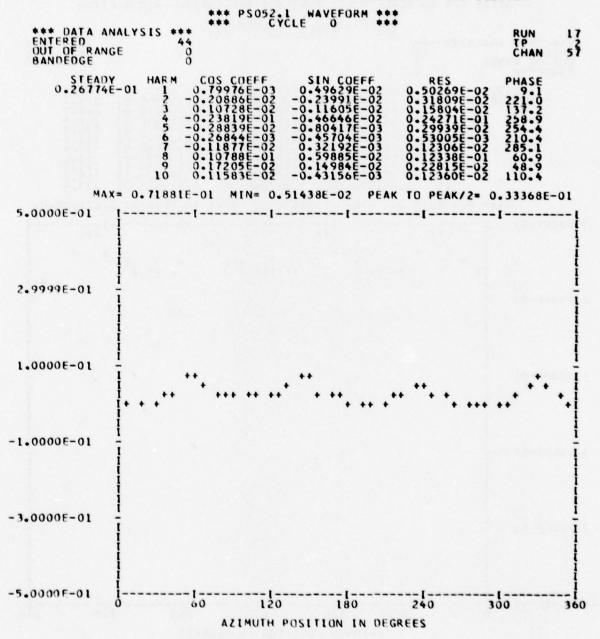


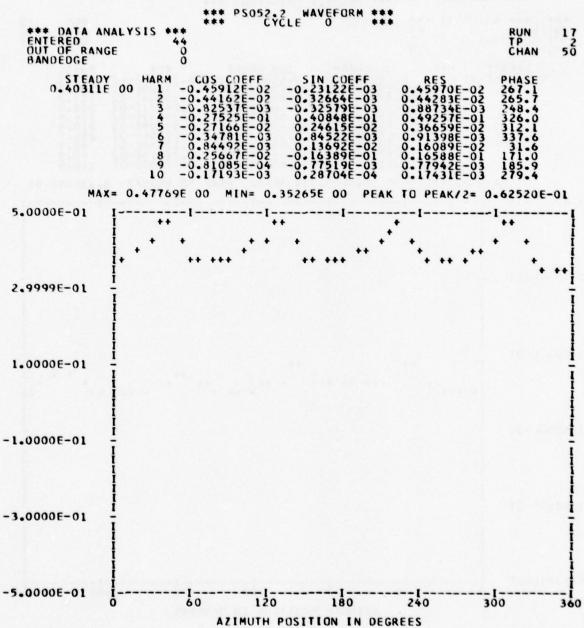


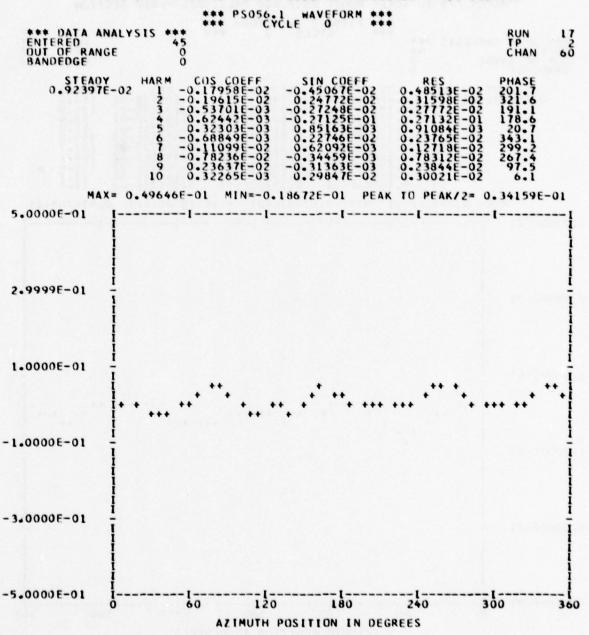


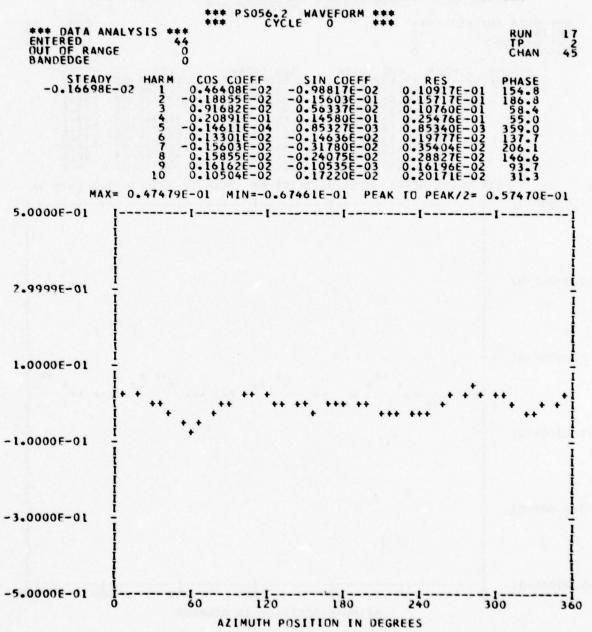


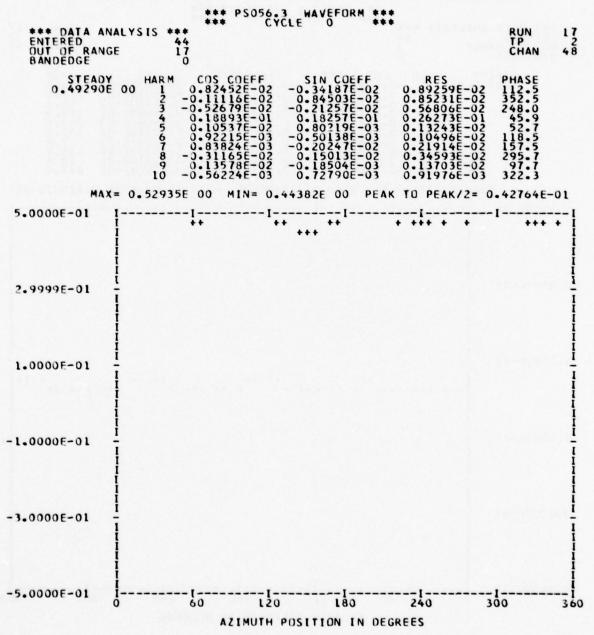


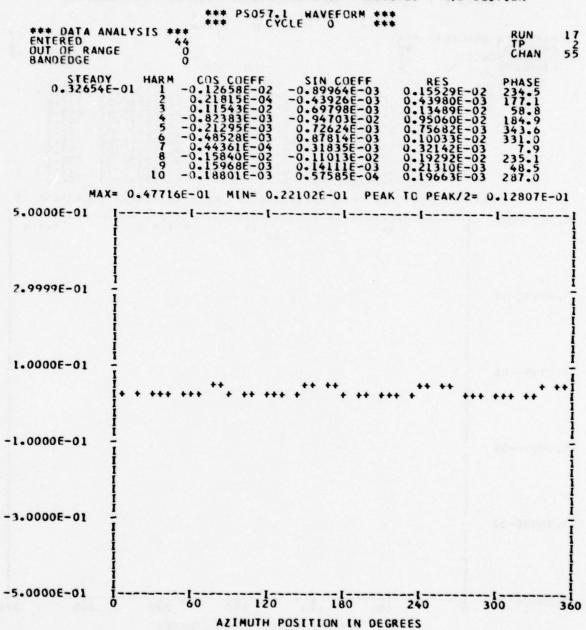


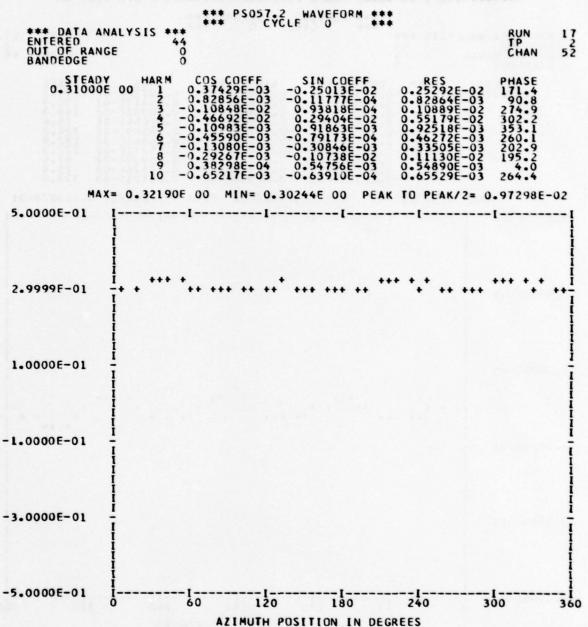


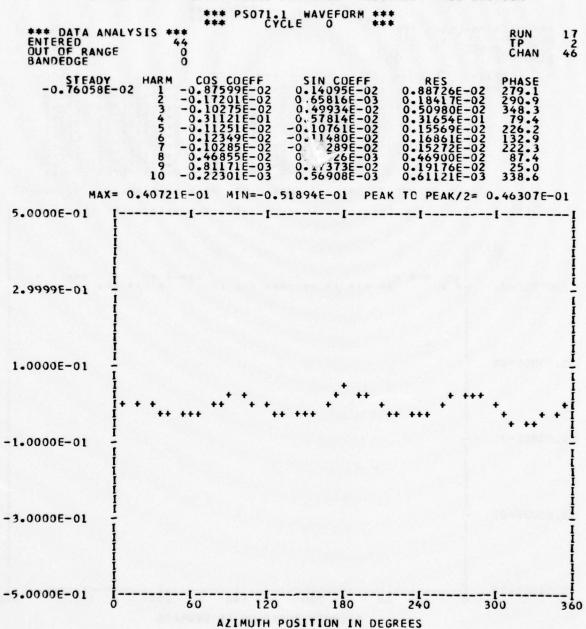


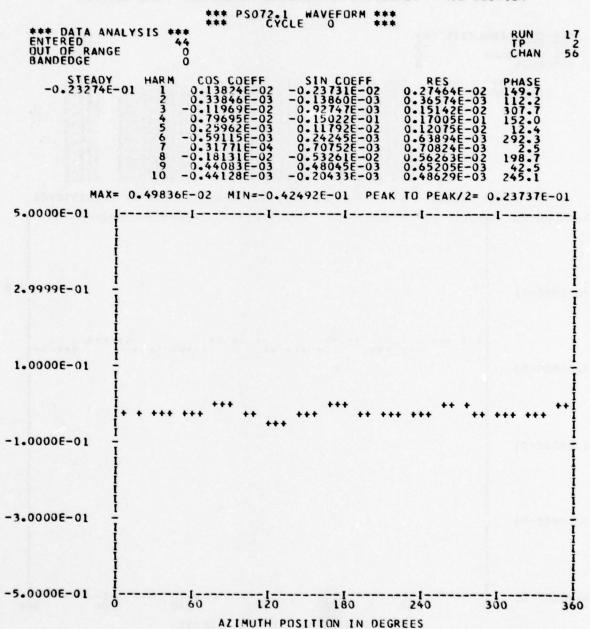


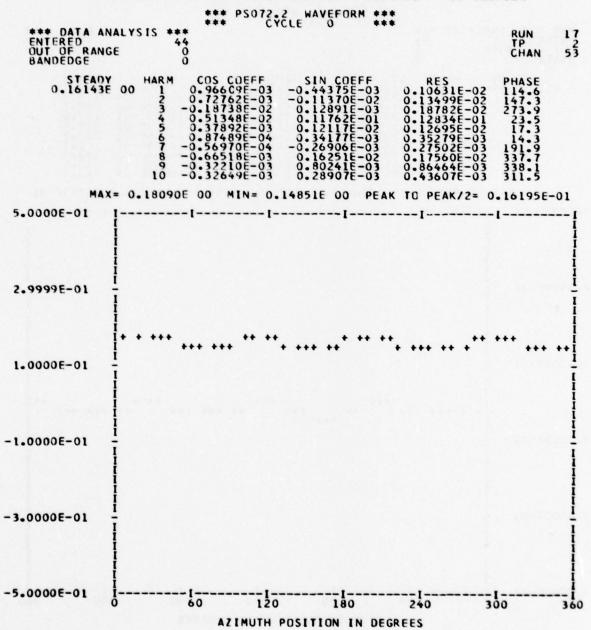




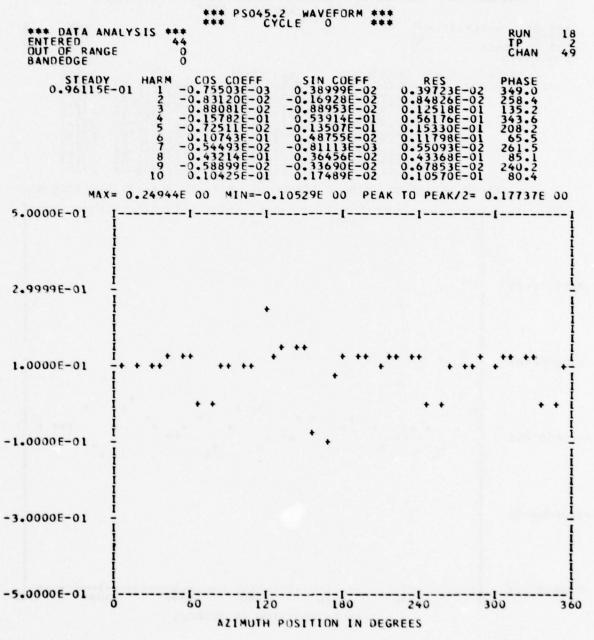


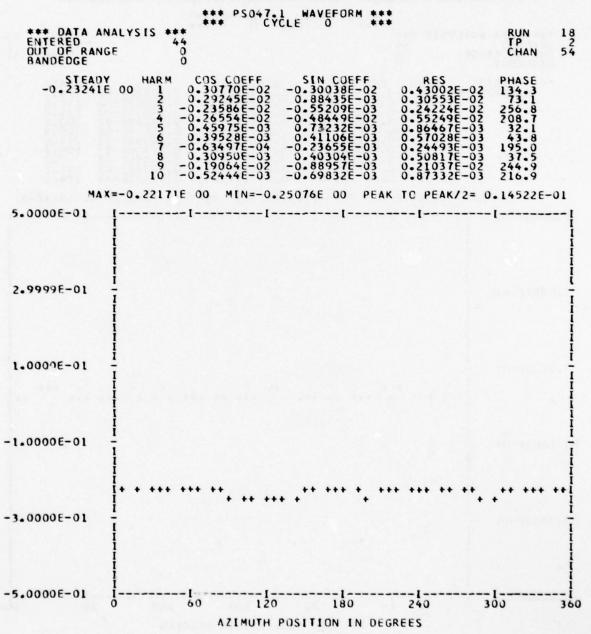


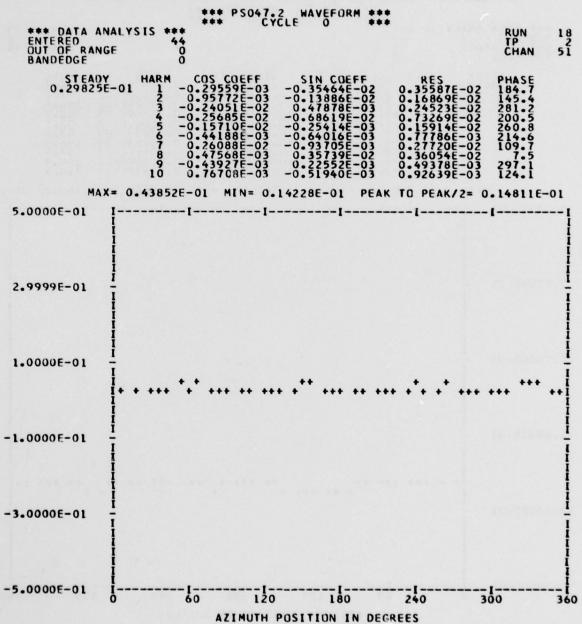


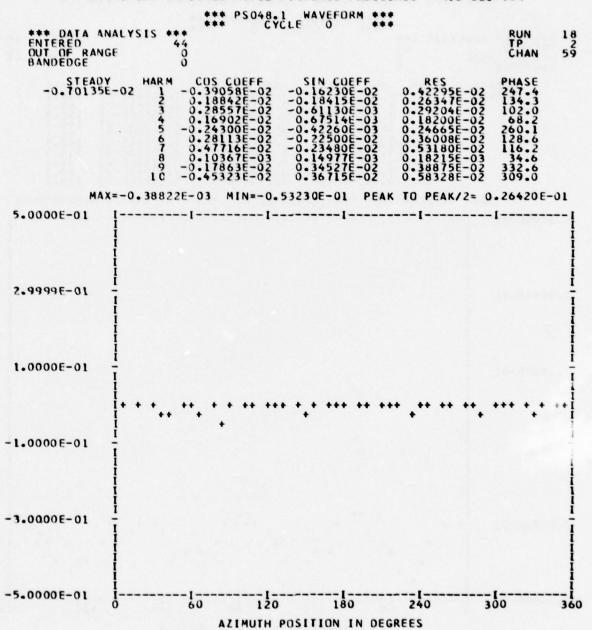


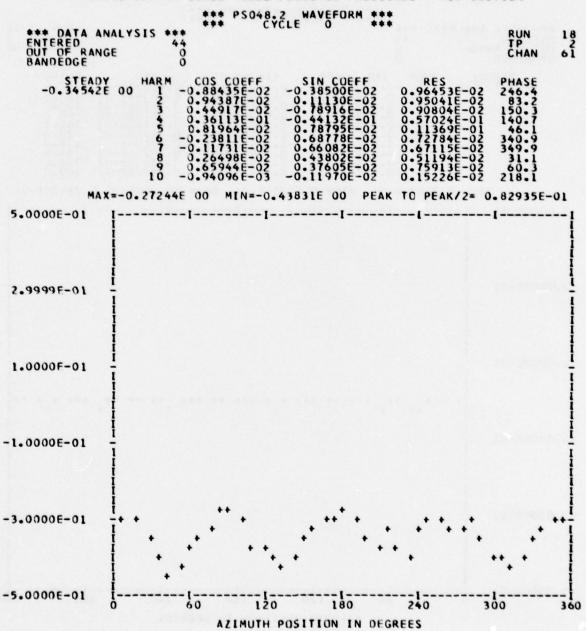
*** PS045.1 WAVEFORM *** *** CYCLE 0 ***		
*** DATA ANALYSIS *** ENTERED 44 OUT OF RANGE 0 BANDEDGE 0	RUN TP CHAN	18 2 58
STEADY HARM COS COEFF SIN COEFF 0.74520E-01 1 -0.16547E-02 -0.78901E-02 0.80617E-02 0.56758E-02 -0.61333E-02 0.83566E-02 0.45157E-01 -0.19091E-01 0.29032E-01 0.21872E-01 -0.19091E-01 0.29032E-01 0.10766E-02 0.27117E-02 0.10766E-02 0.27117E-02 0.39467E-03 0.11010E-02 0.27188E-02 -0.98102E-03 0.28904E-02 0.38279E-01 -0.23949E-01 0.45154E-01 0.29032E-01 0.34200E-02 0.15068E-02 0.37129E-02	PHASE 191.8 137.2 95.0 131.1 293.3 291.0 109.8 122.0 301.0 292.9	
MAX=-0.34883E-03 MIN=-0.15300E 00 PEAK TO PEAK/2= 0	. 76325E	-01
2.9999E-01		111111111111111111111111111111111111111
1.0000E-01		Ī
-1.0000E-01	· ···	++
-3.0000E-01		
-5.0000E-01 i	I	i
AZIMUTH POSITION IN DEGREES		

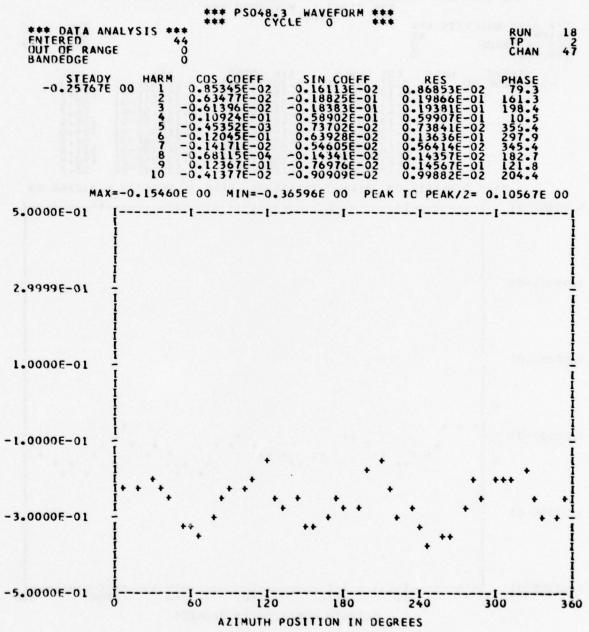


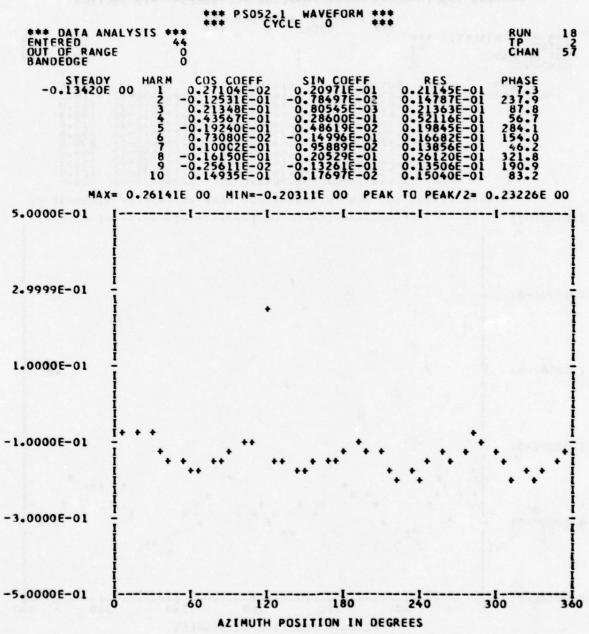


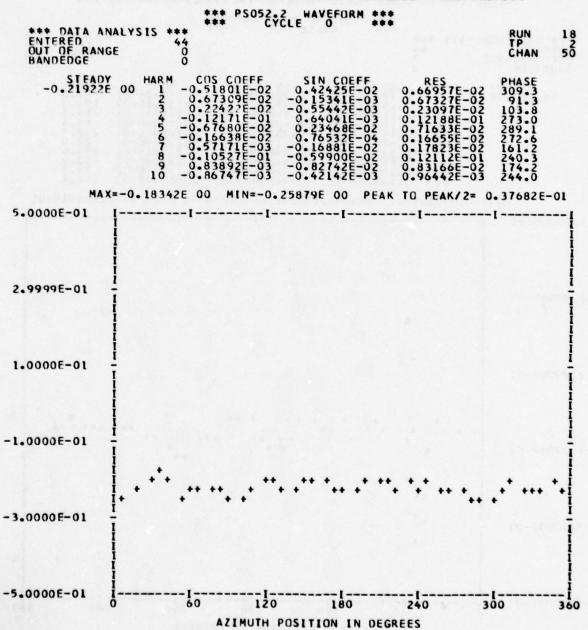


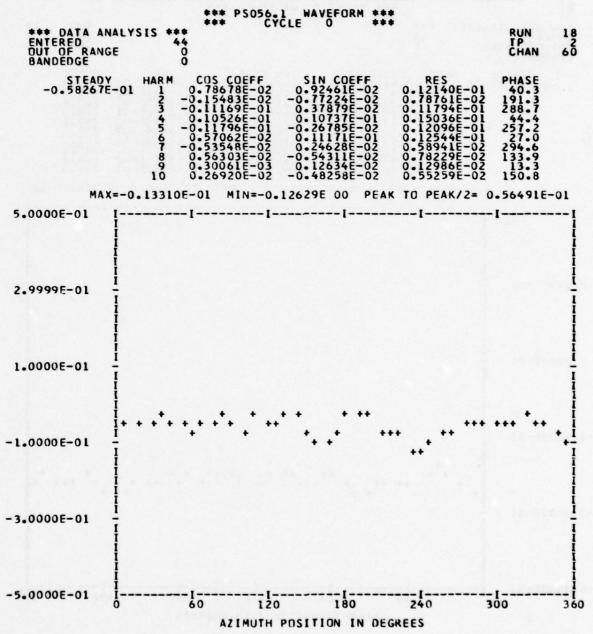


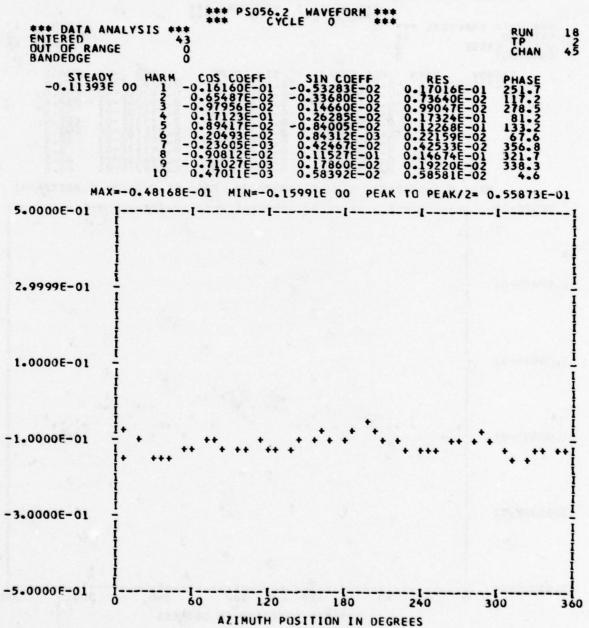


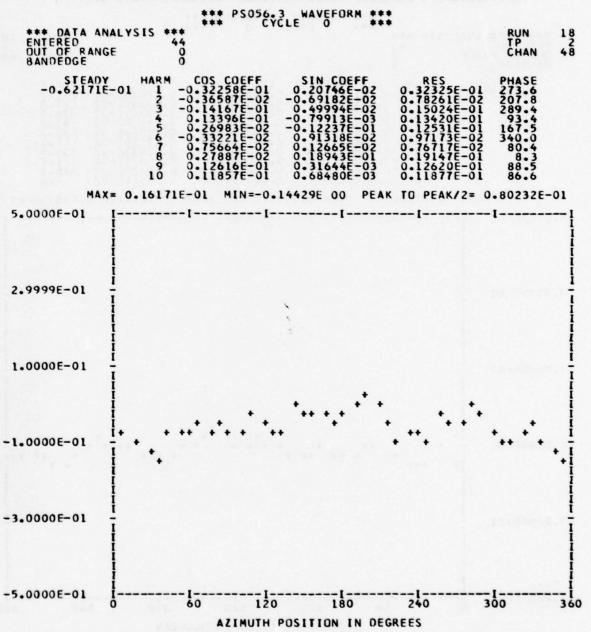


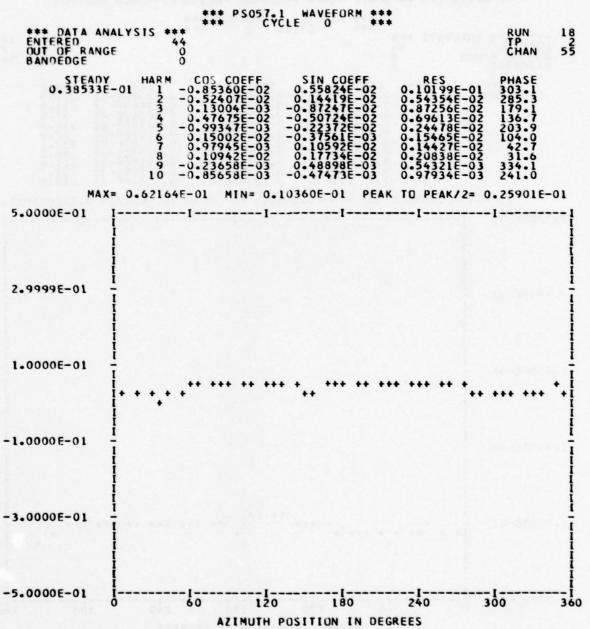




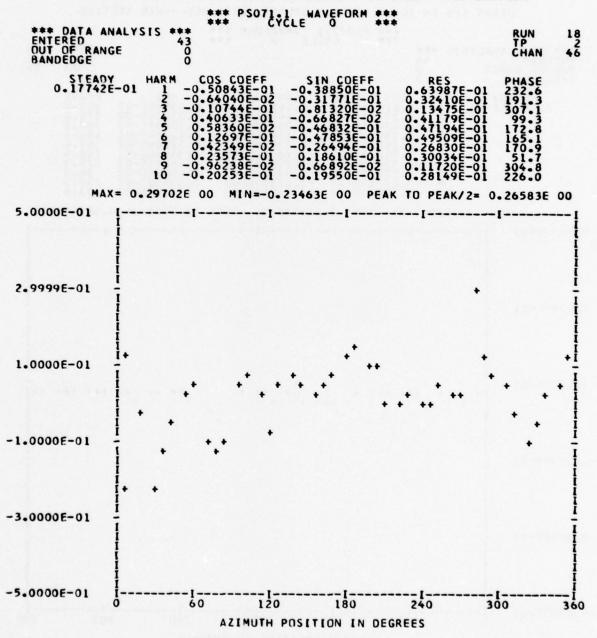


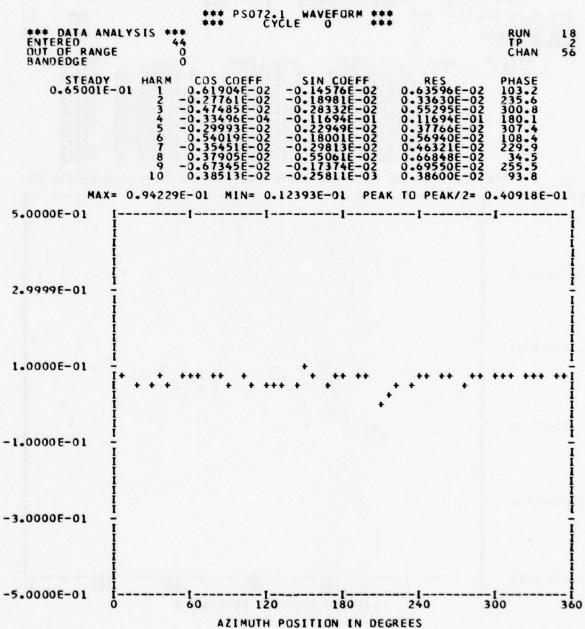


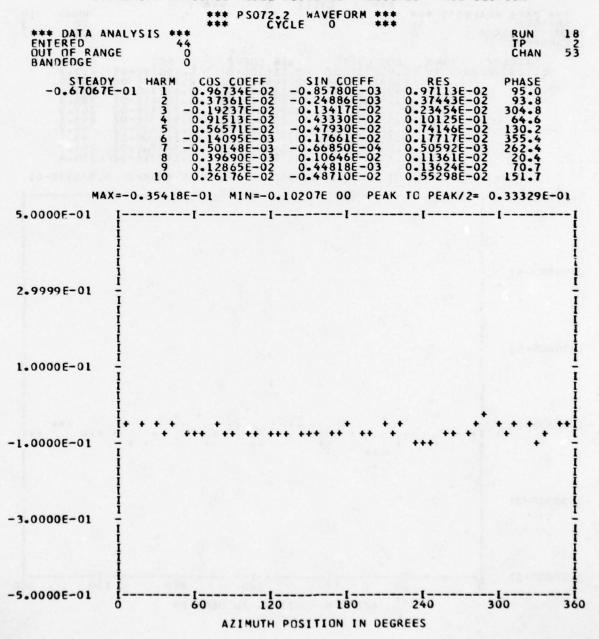


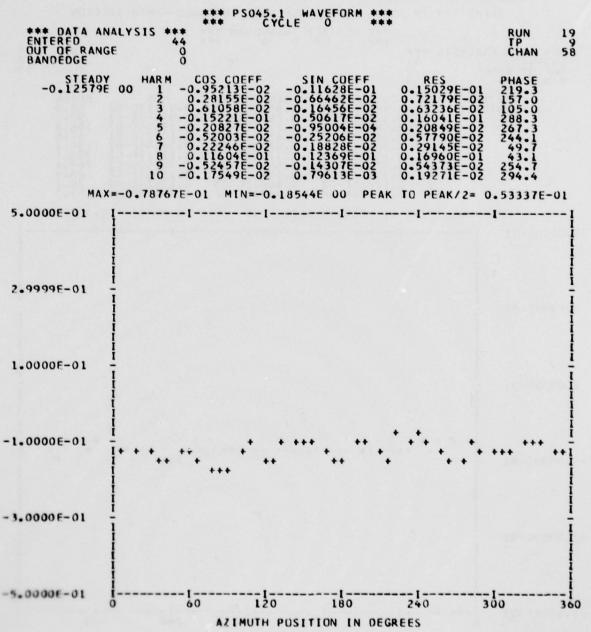


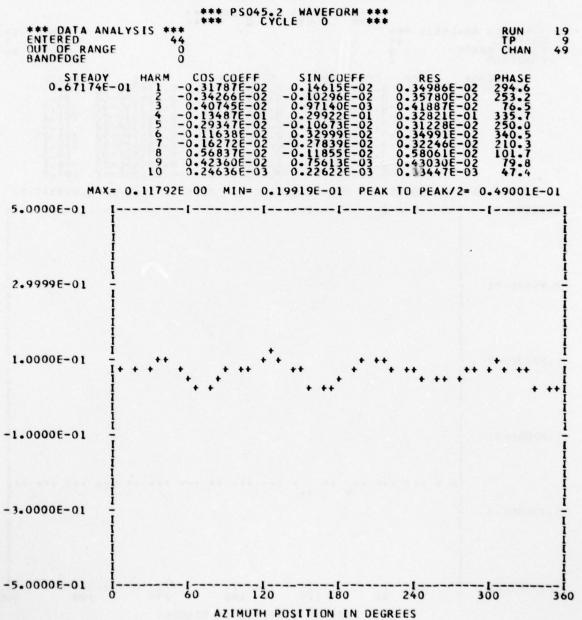
*** PS057.2 WAVEFORM *** *** CYCLE 0 ***	
*** DATA ANALYSIS *** ENTERED 44 OUT OF RANGE 0 BANDEDGE 0	RUN 18 TP 2 CHAN 52
STEADY HARM COS COEFF SIN COEFF O.42071E-02 0.18066E 2 -0.26035E-02 -0.42523E-02 0.49860E 3 0.62746E-02 0.81292E-02 0.8156E 5 0.15555E-02 0.38492E-02 0.41516E 6 -0.65449E-03 0.12380E-02 0.14003E 7 0.21021E-02 0.77922E-04 0.21033E 8 -0.26794E-02 0.37559E-02 0.46136E 9 0.12729E-02 -0.66870E-03 0.14378E 10 -0.32752E-03 0.28346E-03 0.43315E	-02 211.4 -01 37.6 -02 336.5 -02 22.0 -02 332.1 -02 88.0 -02 324.4 -02 117.7
MAX=-0.28366E 00 MIN=-0.34606E 00 PEAK TO PEAK/	2= 0.31202E-01
2.9999E-01	
1.0000E-01	
-1.0000E-01	
-3.0000E-01	*** ***
-5.0000E-01 IIIIIII	I

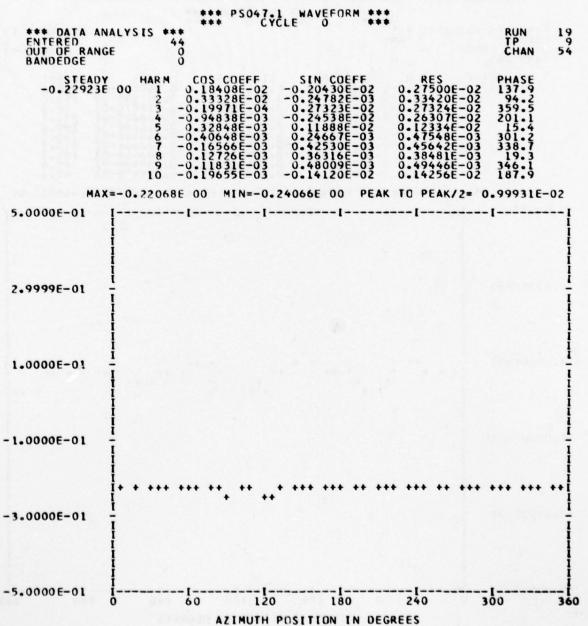


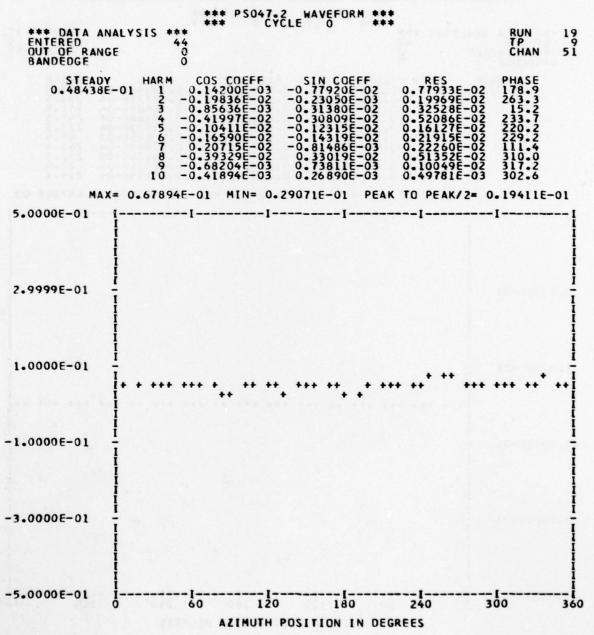


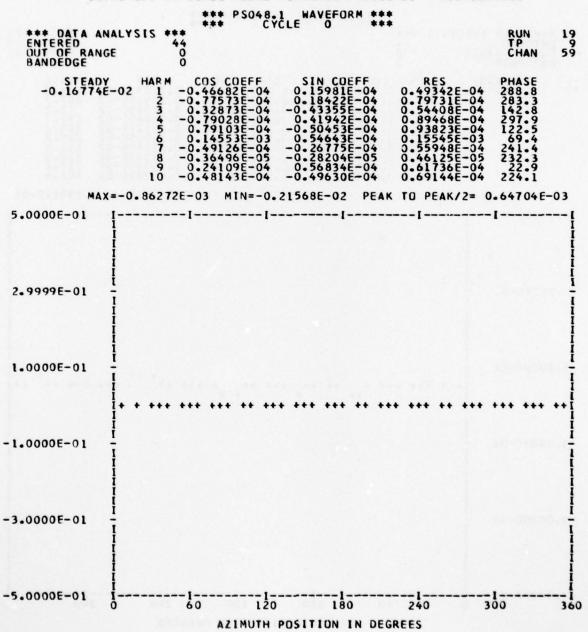


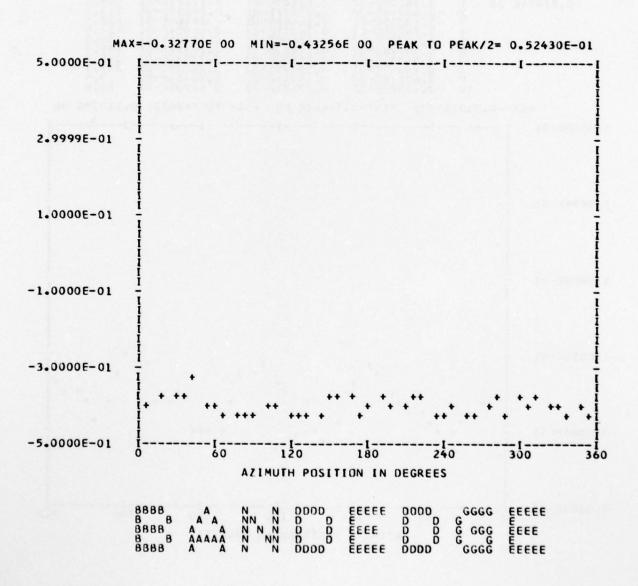


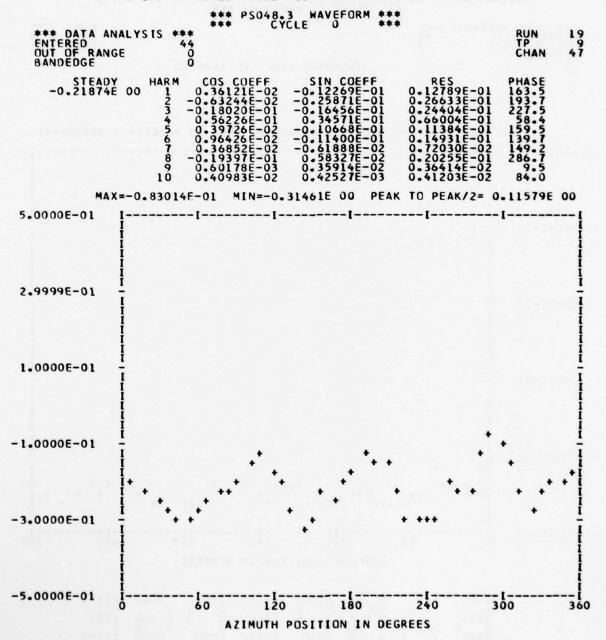


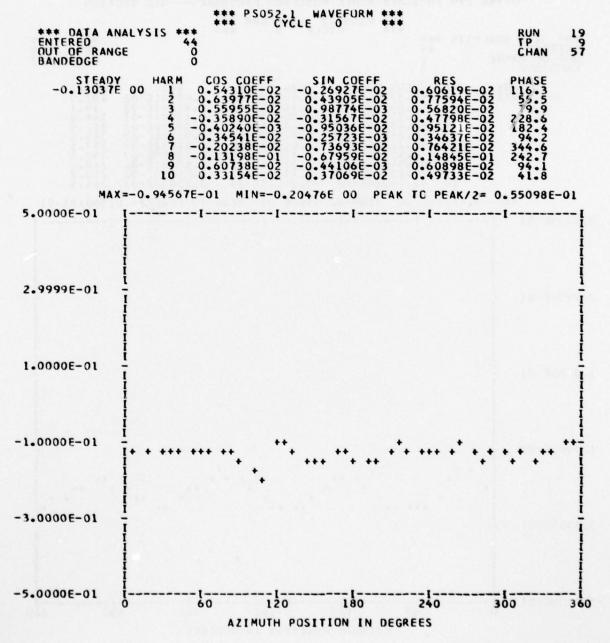


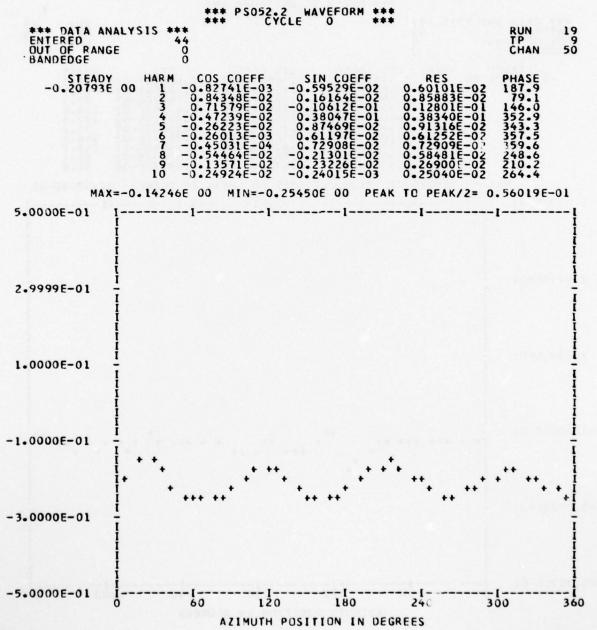


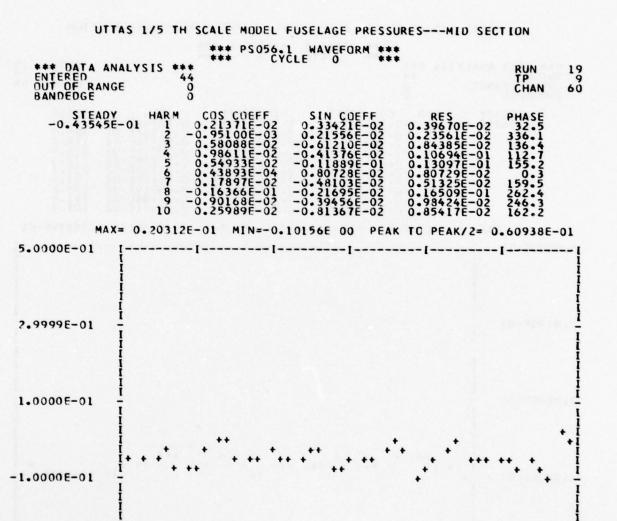












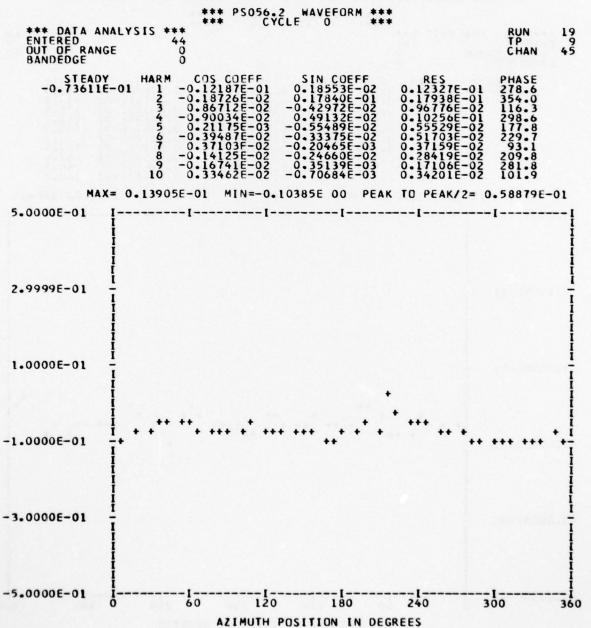
180

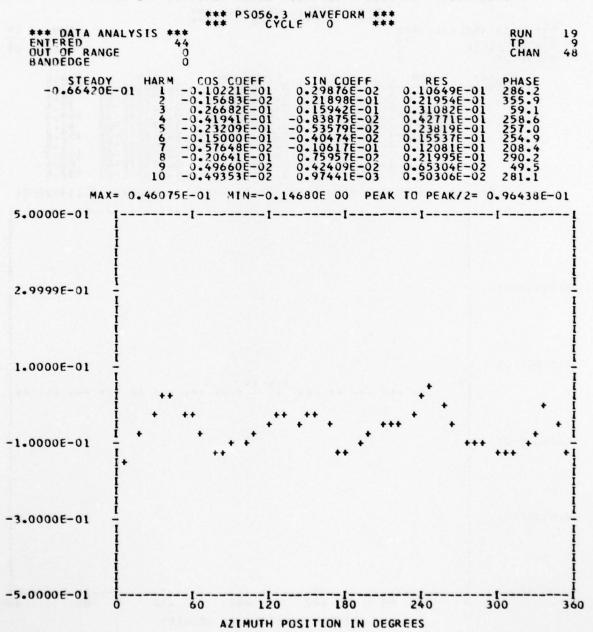
AZIMUTH POSITION IN DEGREES

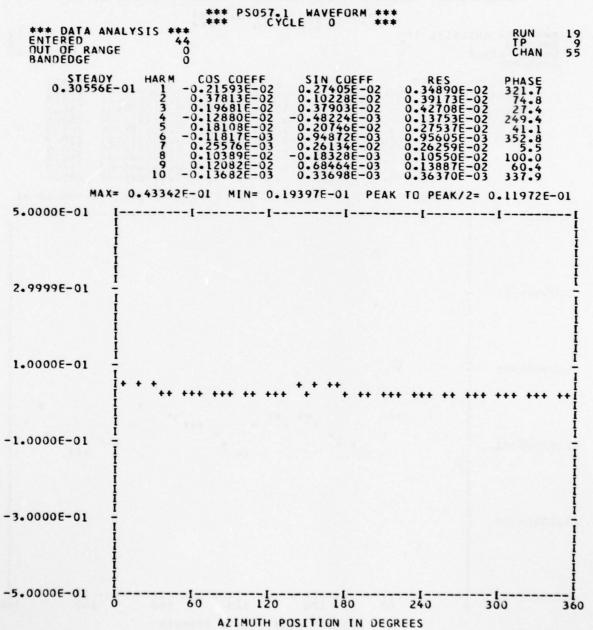
300

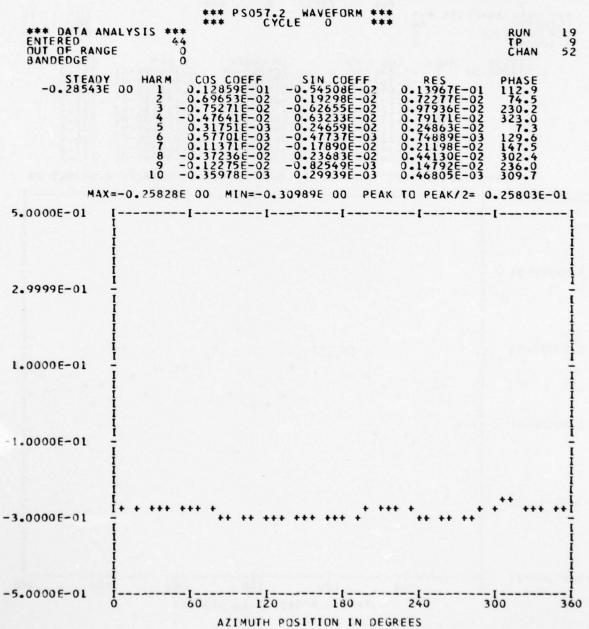
-3.0000F-01

-5.0000E-01

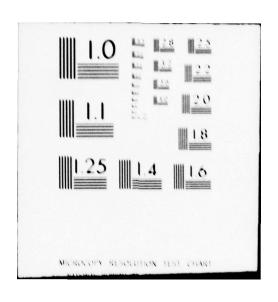


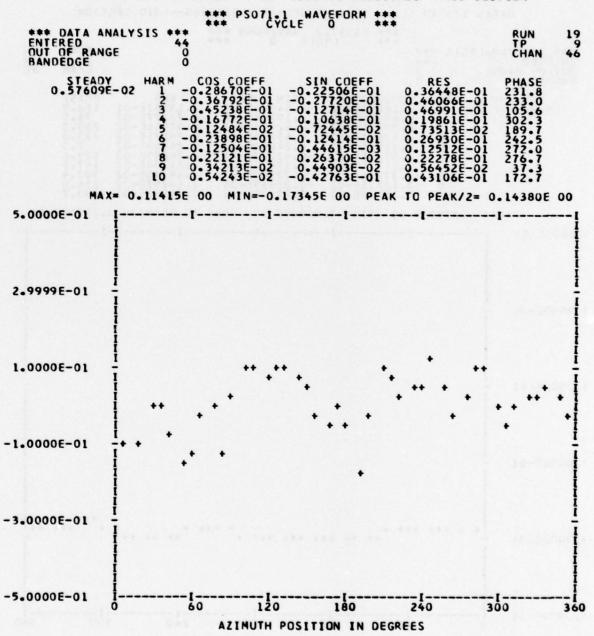


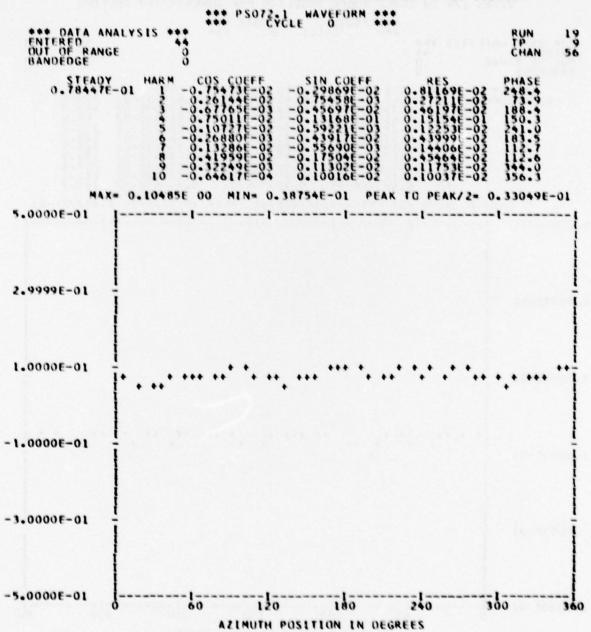


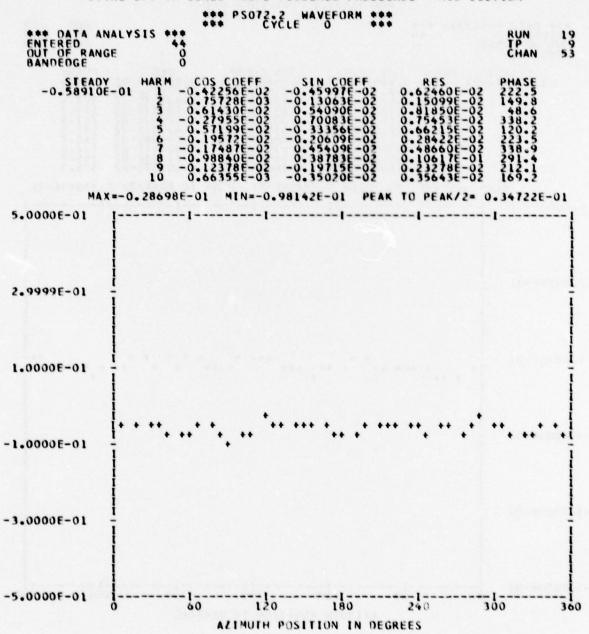


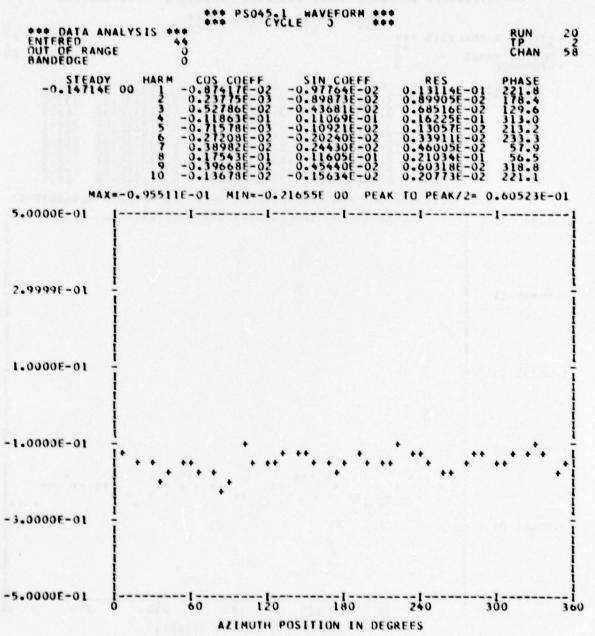
BOEING VERTOL CO PHILADELPHIA PA INTERACTIONAL AERODYNAMICS OF THE SINGLE ROTOR HELICOPTER CONFI--ETC(U) AD-A060 868 SEP 78 P F SHERIDAN DAAJ02-77-C-0020 UNCLASSIFIED USARTL-TR-78-238-V2-E NL 20=2 -iomoi - innai an ai "Finnel" inmai mmnt 'annoi mmai 國際由 MMai **Rani** AD A060 868 man 養養事 mmmi 関膜療 湖面由 mmat | 衛順車(BES mmai mmai -*innai mmai Tinoni Inmai mm mi muni mani moni in m mi MMai - 開業 "国用由7 - 国用自己 0.00 南田市 THE RE BEST **Samul** *innat - 自然也 mmai in mai immort. mmni mani mmot mmai END DATE FILMED 1-79 DDC

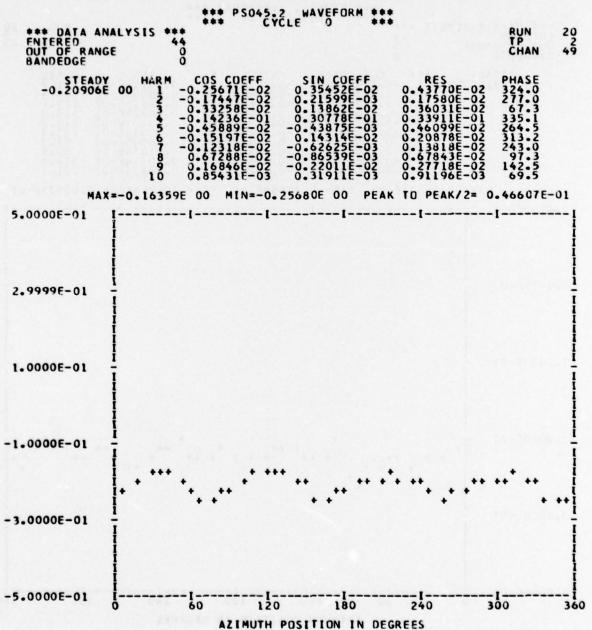


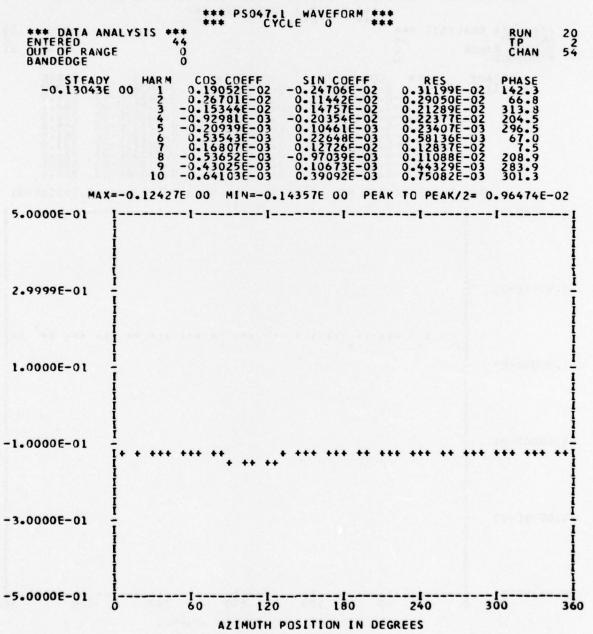


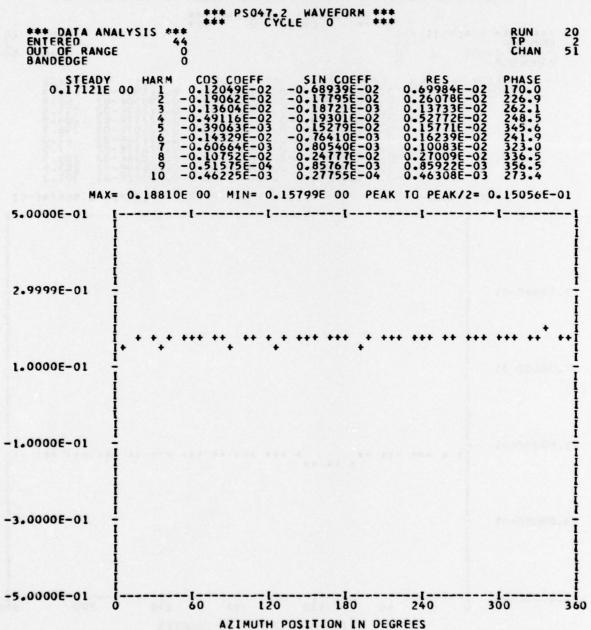


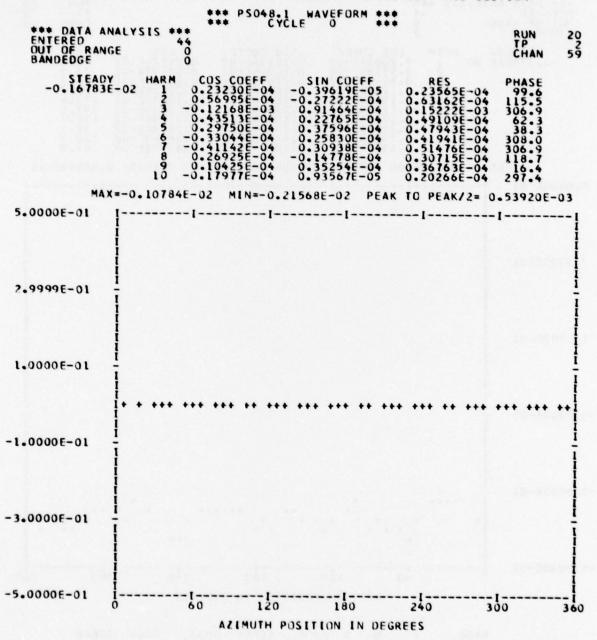


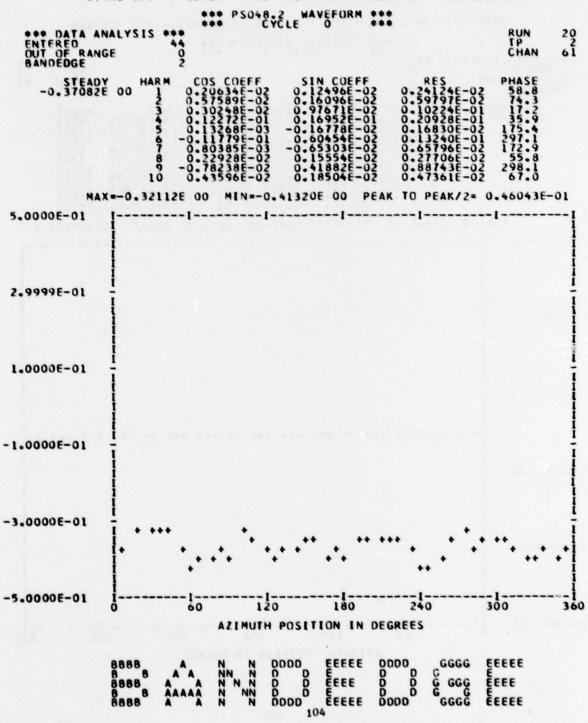


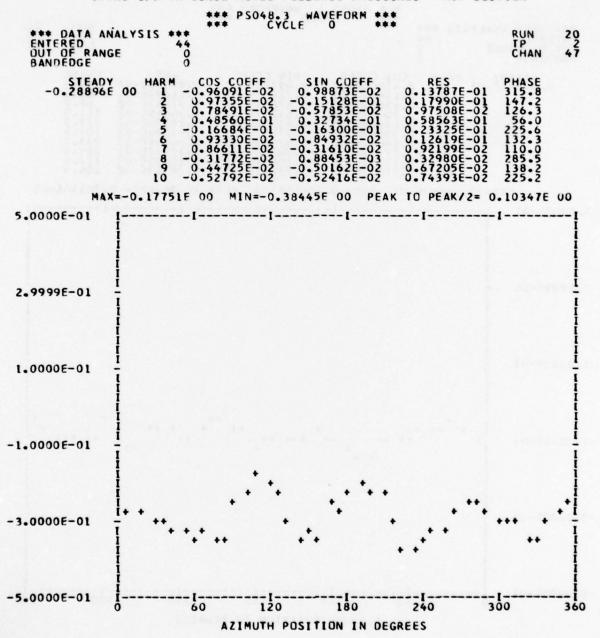


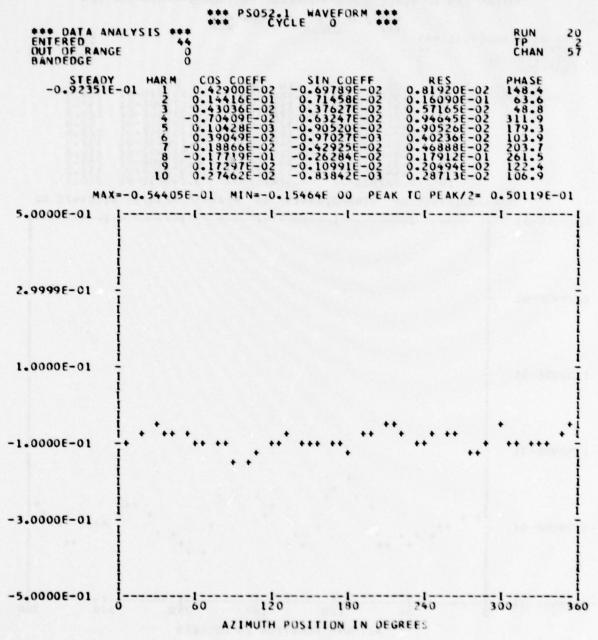


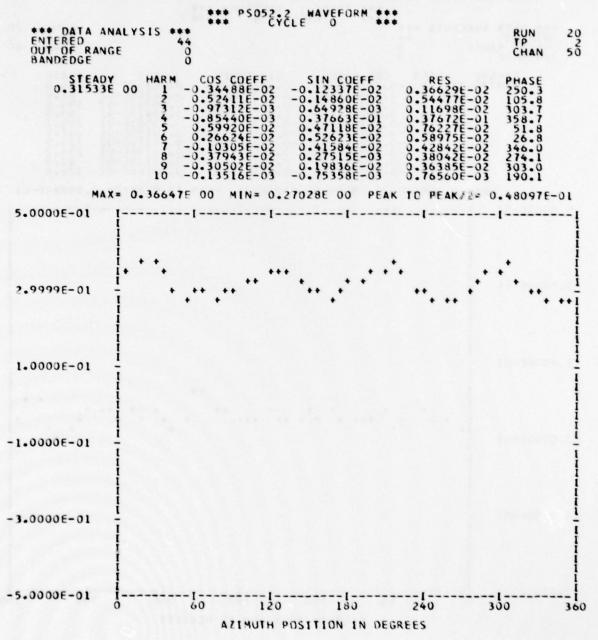


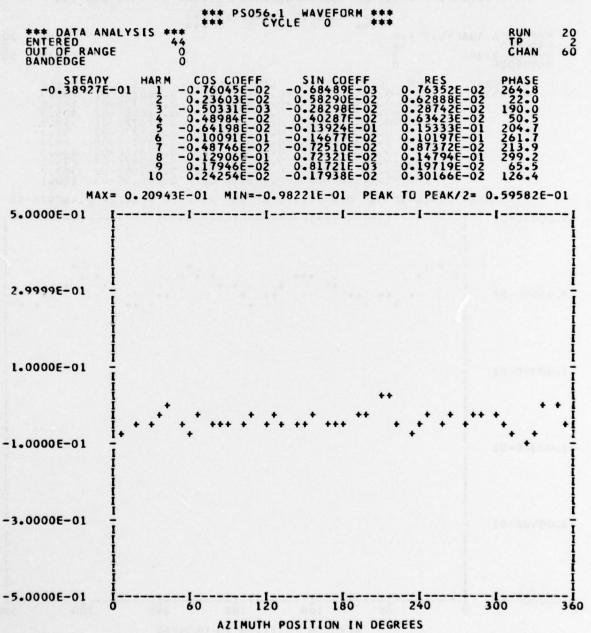


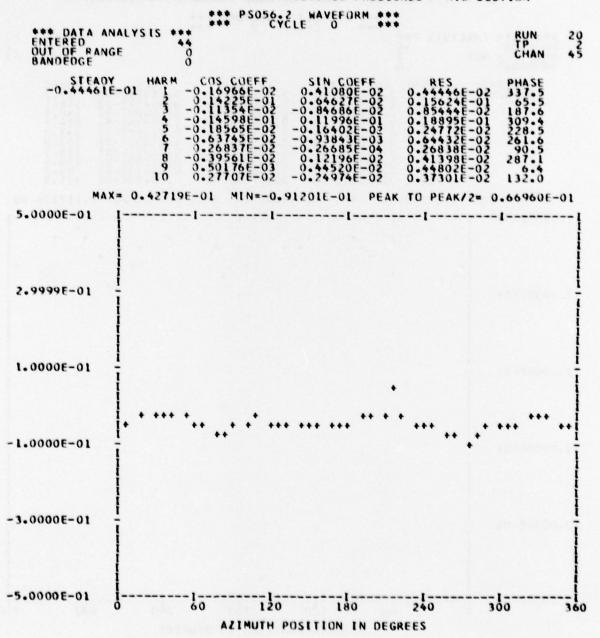


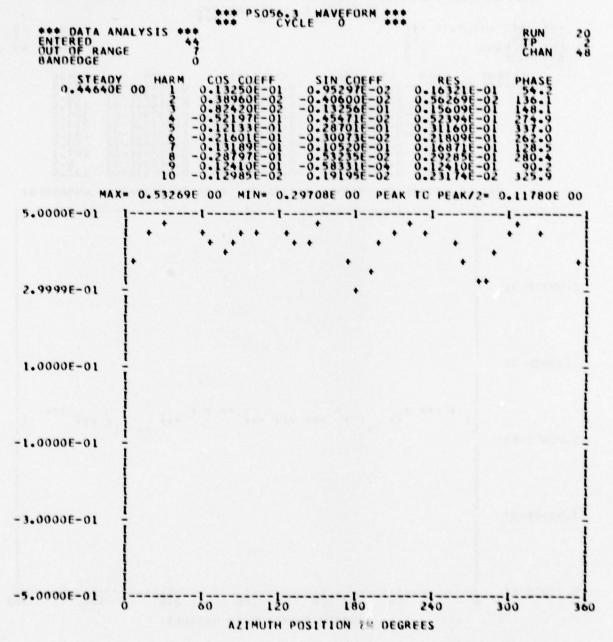


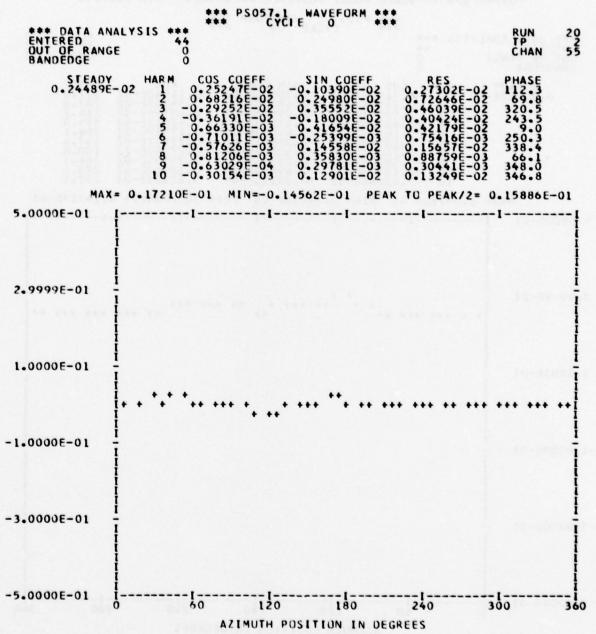


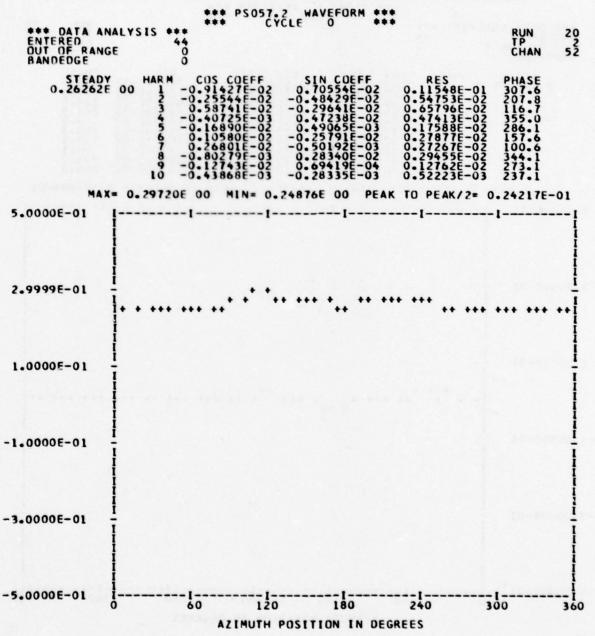


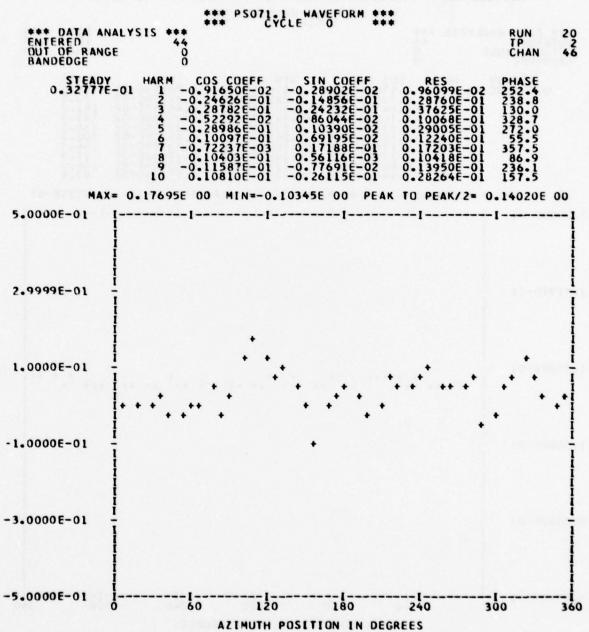


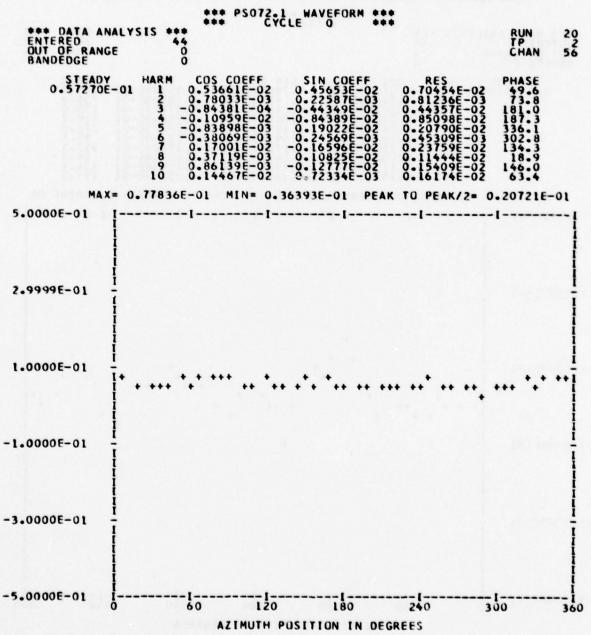


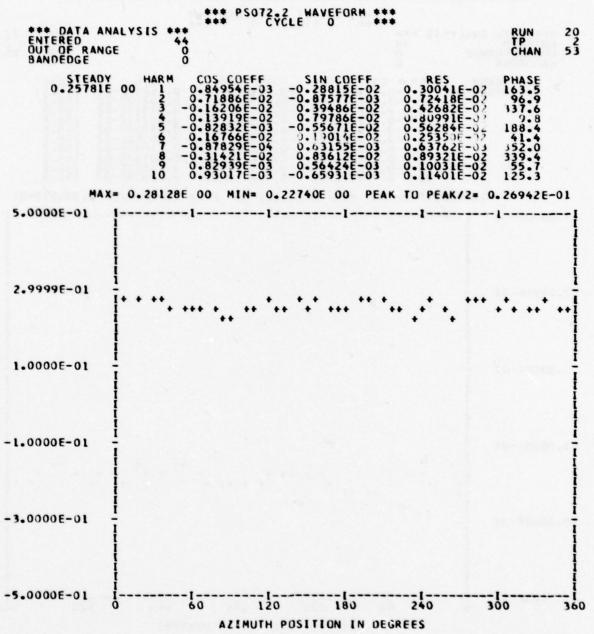


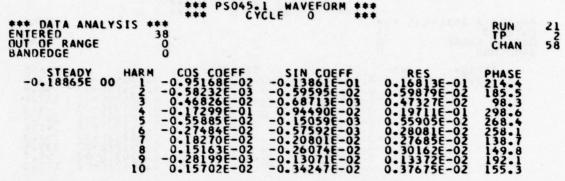




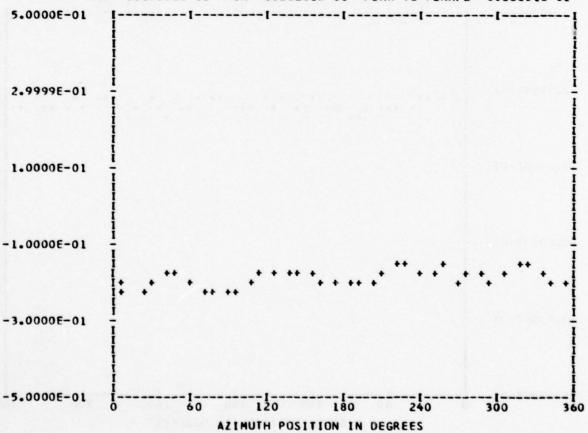


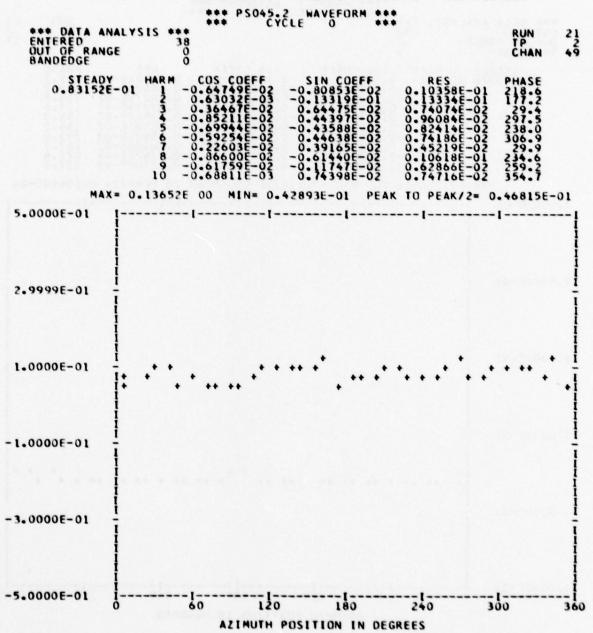


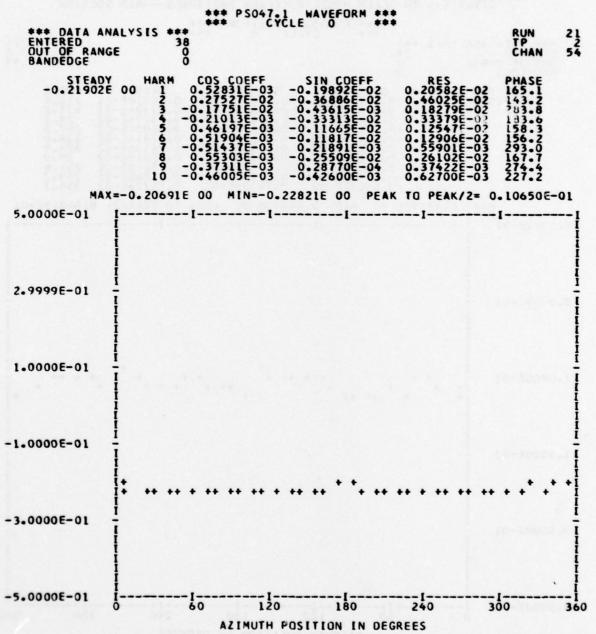


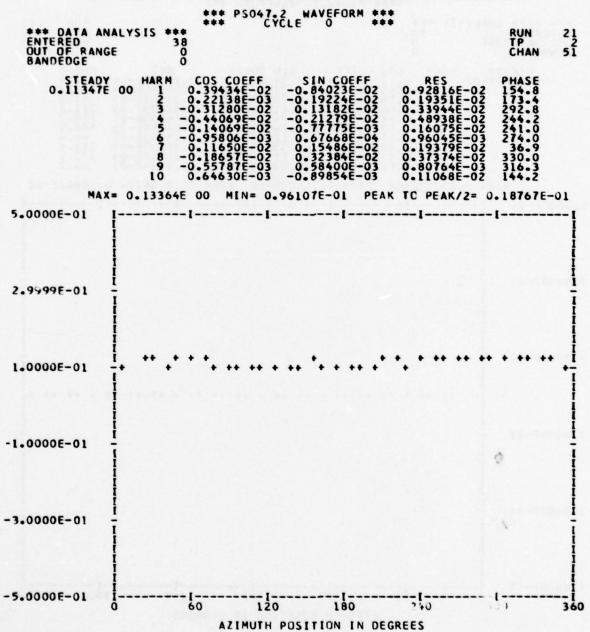


MAX=-0.15551E 00 MIN=-0.23281E 00 PEAK TO PEAK/2= 0.38651E-01





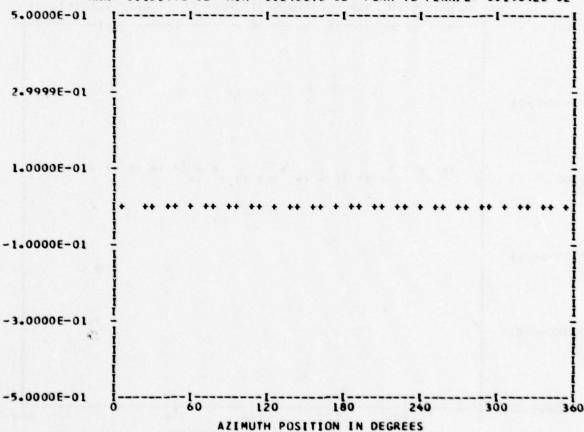




TTAS 1/5 TH SCALE MODEL FUSELAGE PRESSURES---MID SECTION *** PS048.1 WAVEFORM *** CYCLE 0 *** DATA ANALYSIS *** ENTERED OUT OF RANGE 0

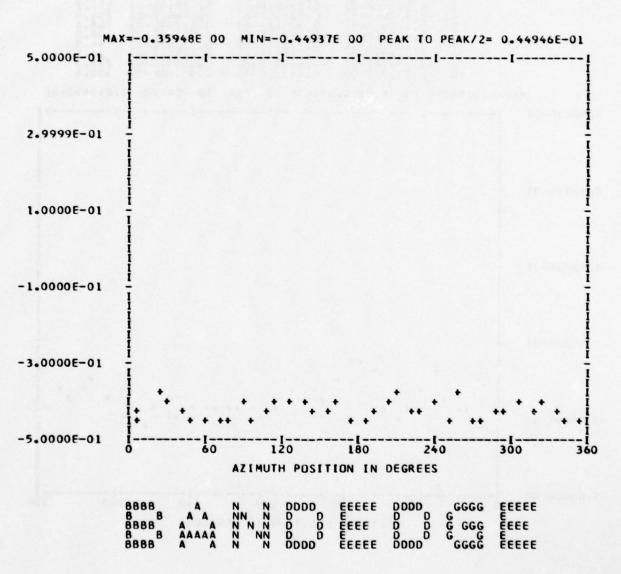
OUT OF RANGE		8			CHAN
STEADY -0.12464E-02	HAR M 1 2 3 4 5 6 7 8 9 10	COS COEFF 0.17517E-04 -0.43709E-03 0.14571E-03 -0.66963E-04 -0.14480E-03 -0.10608E-04 0.13346E-03 0.83671E-04 -0.93479E-04	SIN COEFF 0.39067E-05 0.25903E-04 0.79596E-04 -0.11018E-03 0.24760E-04 0.14951E-03 -0.30066E-03 0.11776E-04 0.50081E-04	RES 0.17947E-04 0.43786E-03 0.16603E-03 0.12894E-03 0.14690E-03 0.17553E-03 0.31209E-03 0.94218E-04 0.11334E-03	PHASE 77.4 273.3 61.3 211.7 355.9 49.4 164.4 277.1 63.7
		~	0.00000	OCTTONE OF	

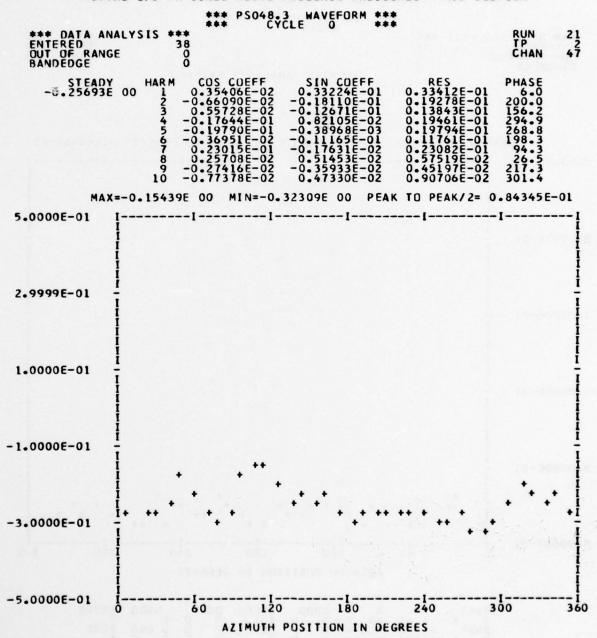
MAX= 0.15097E-02 MIN=-0.24587E-02 PEAK TO PEAK/2= 0.19842E-02

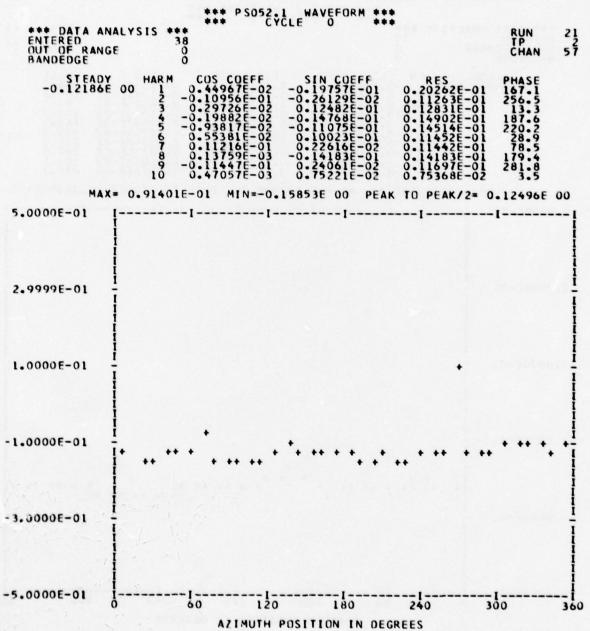


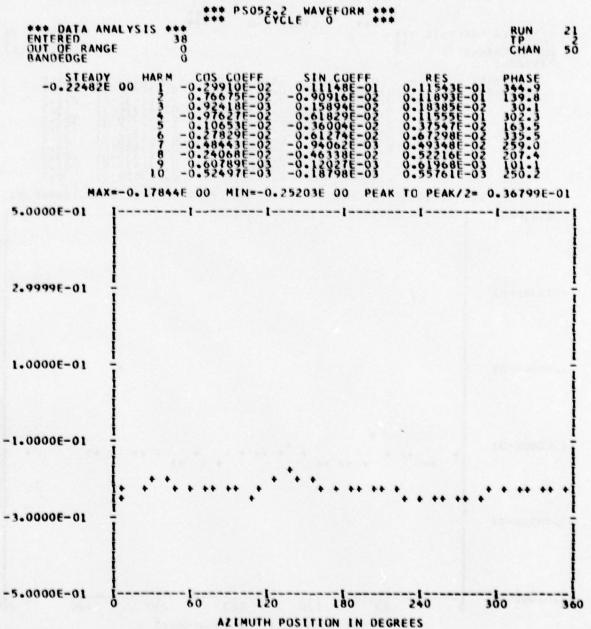
*** PSO48.2 WAVEFORM ***

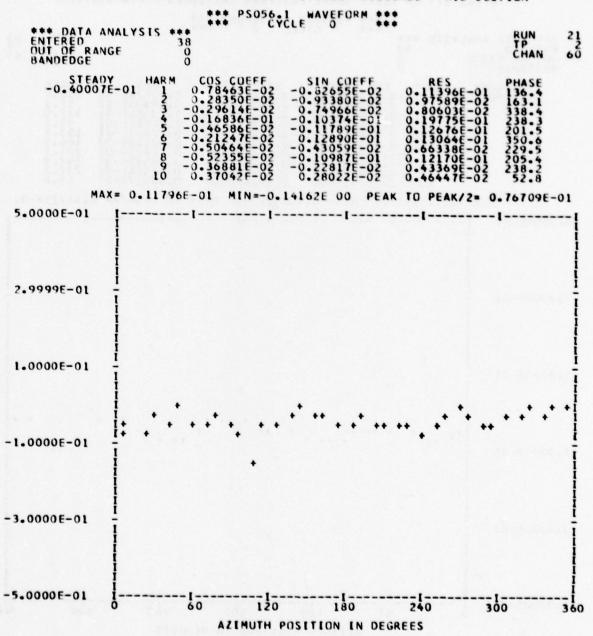
*** DATA ANALYSIS ***
ENTERED 38
OUT OF RANGE 0
BANDEDGE 9
HARMONIC ANALYSIS SKIPPED

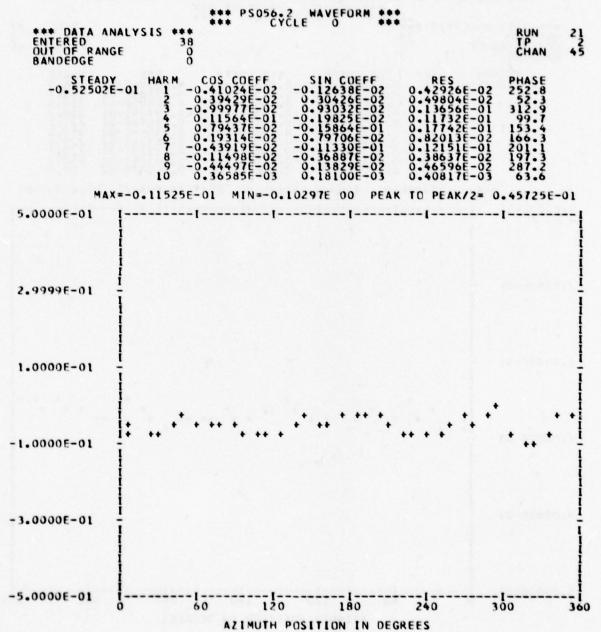


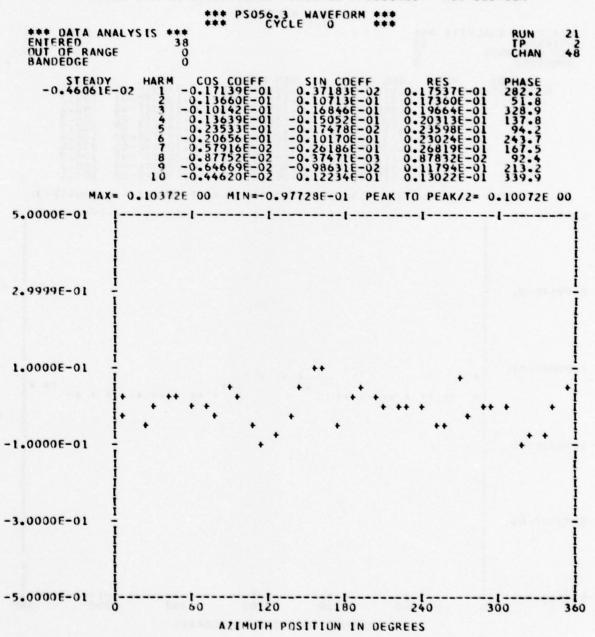


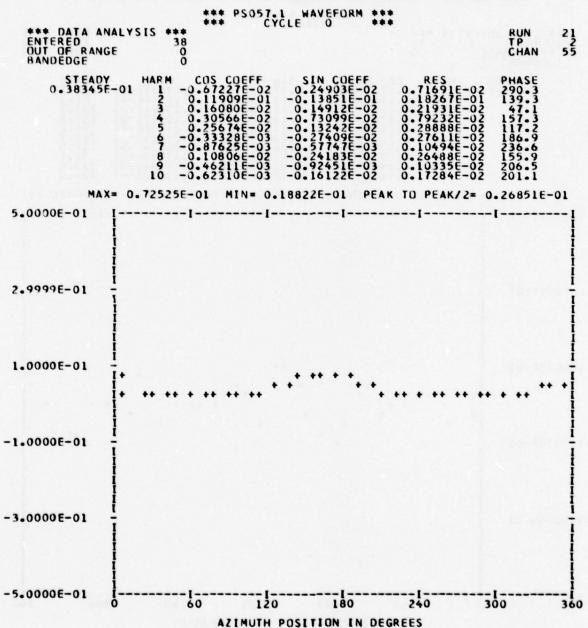


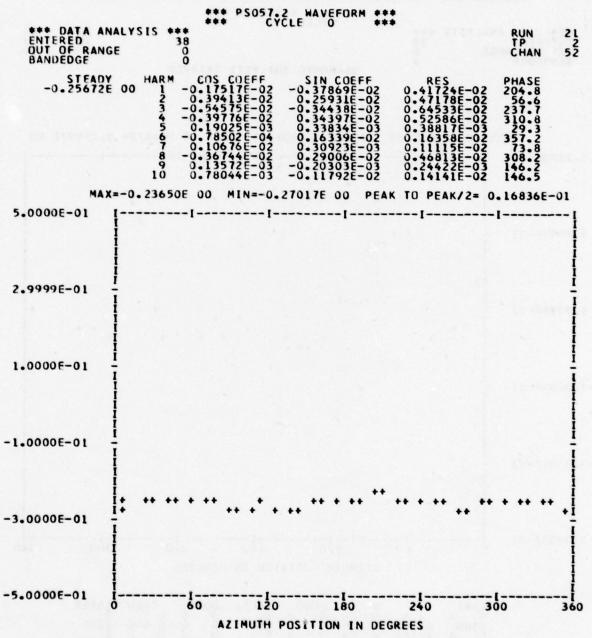






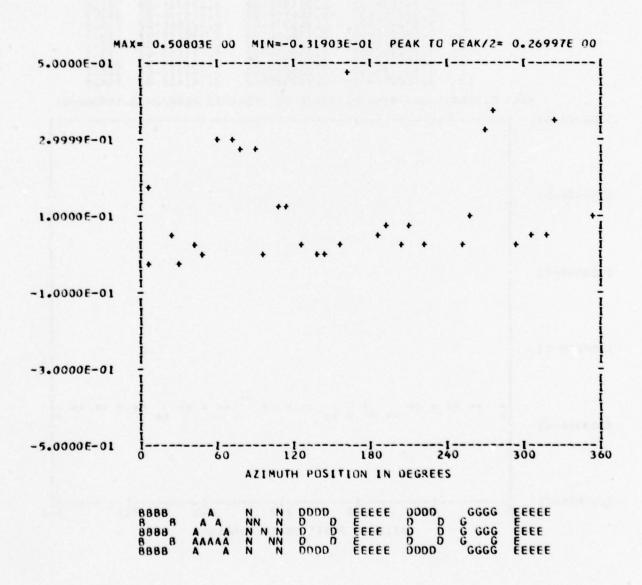


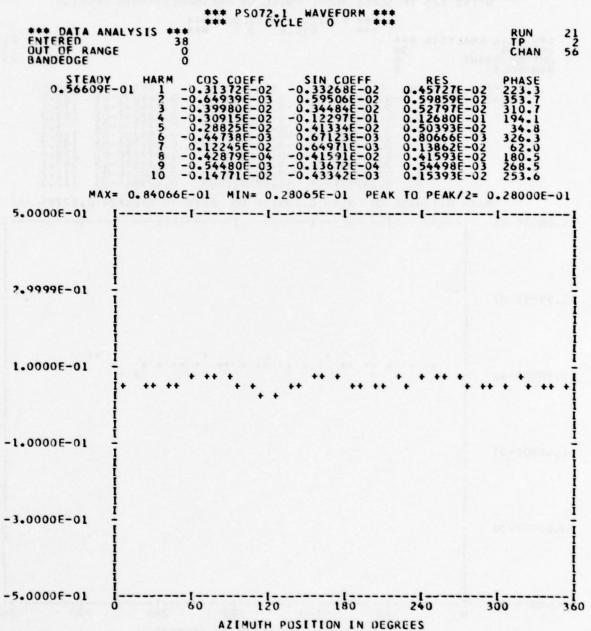


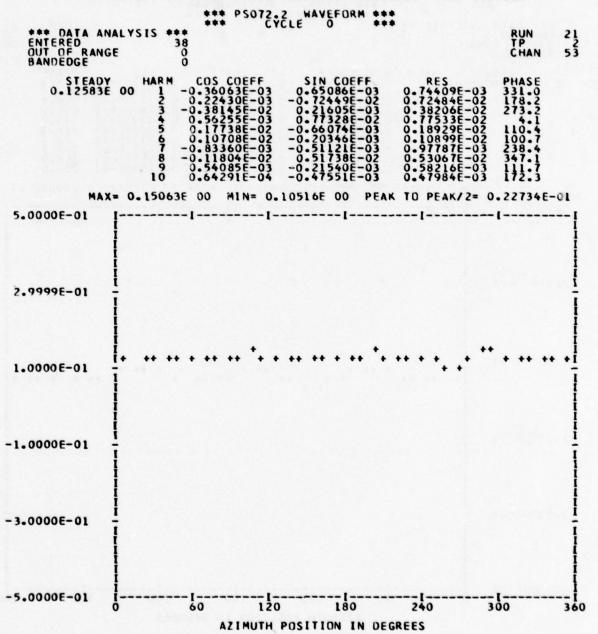


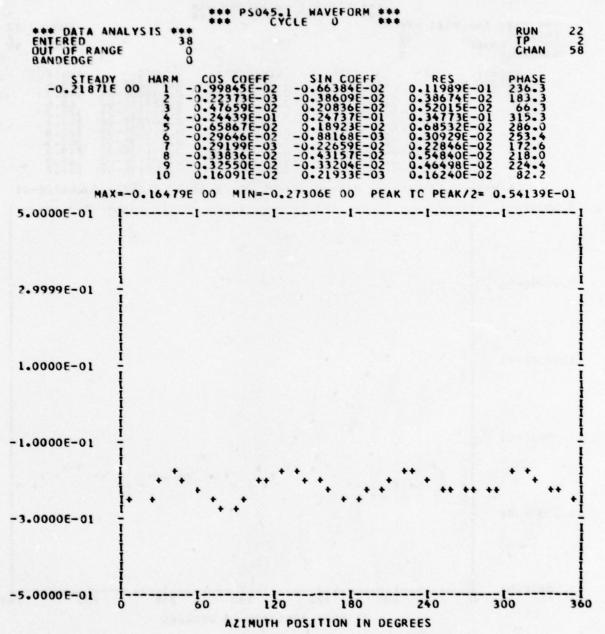
*** PSO71.1 WAVEFORM ***

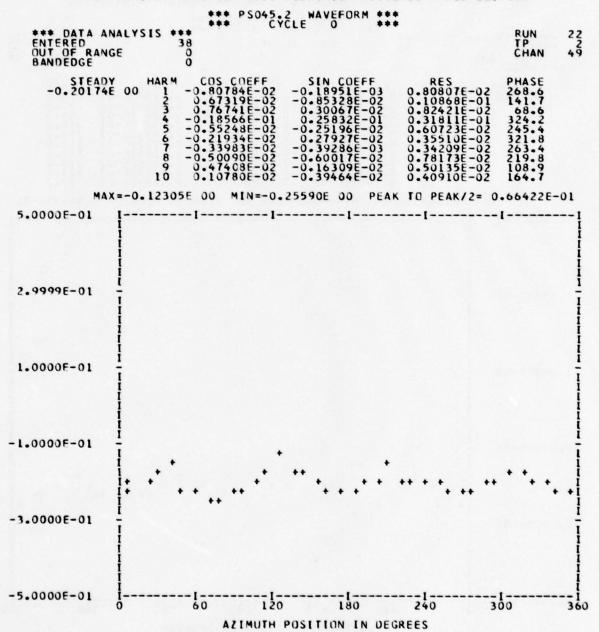
*** DATA ANALYSIS ***
ENTERED 38 TP 2
OUT OF RANGE 6
BANDEDGE 6
HARMONIC ANALYSIS SKIPPED

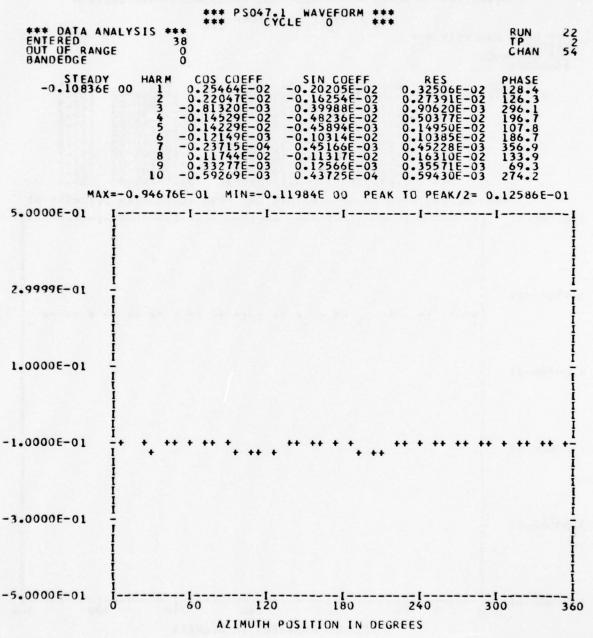












UTTAS 1/5 TH SCALE MOVEL FUSELAGE PRESSURES --- MID SECTION *** DATA ANALYSIS *** ENTERED OUT OF RANGE BANDEDGE 0 0.24781E 00 1 MAX= 0.26207E 00 5.0000E-01 2.9999E-01 1.0000E-01 -1.0000E-01 -3.0000E-01

60

120 180

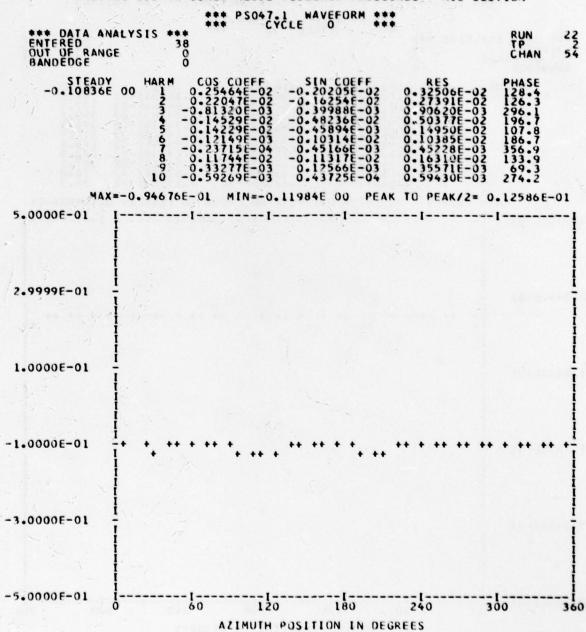
AZIMUTH POSITION IN DEGREES

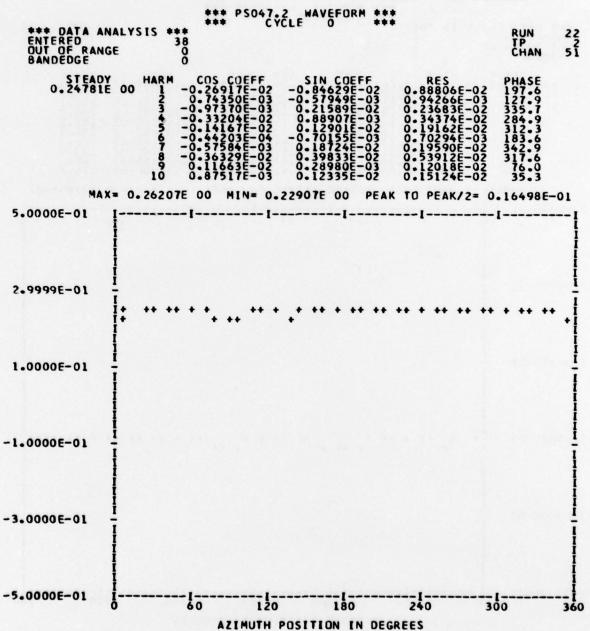
240

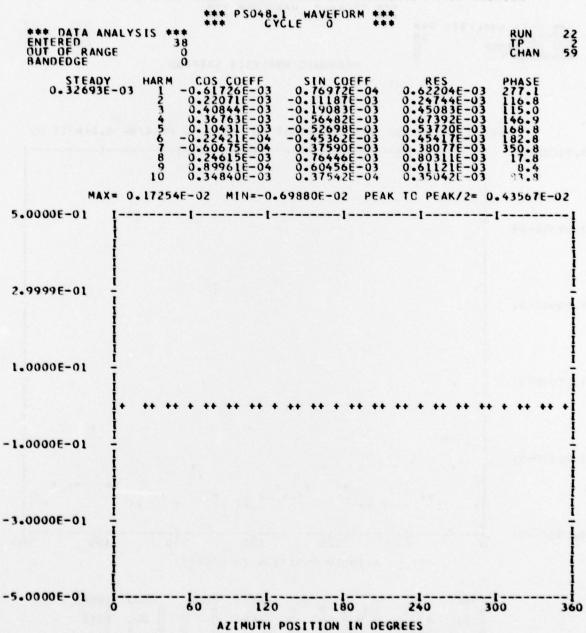
300

360

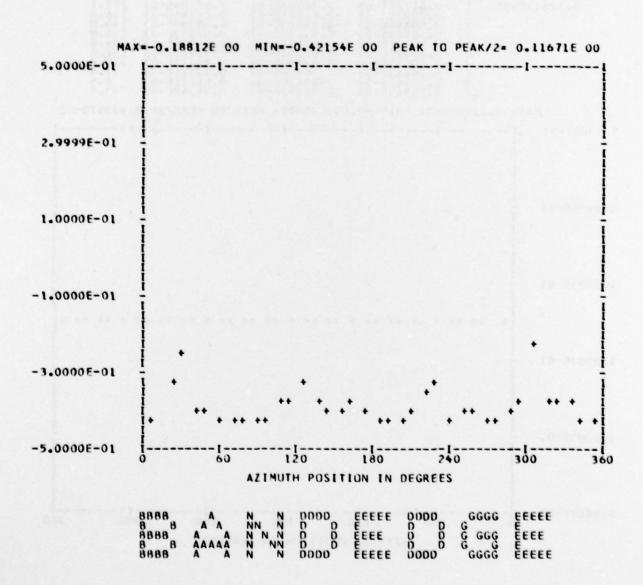
-5.0000E-01

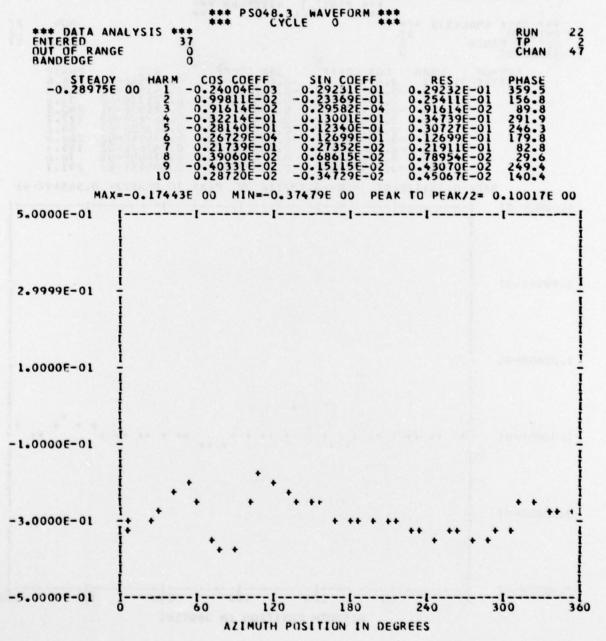


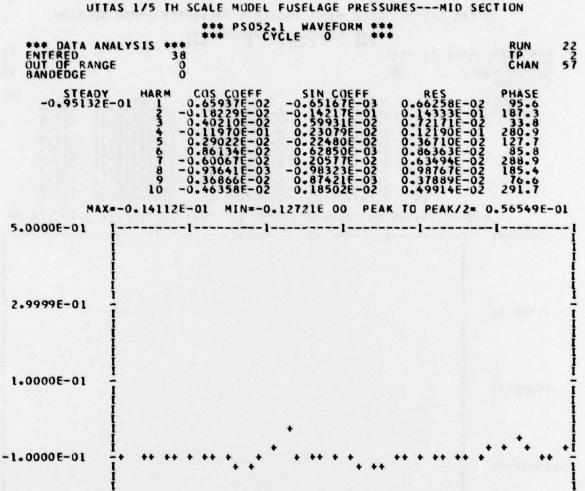




*** DATA ANALYSIS ***
ENTERED 38
OUT OF RANGE 0
BANDEDGE 8
HARMONIC ANALYSIS SKIPPED







120 180

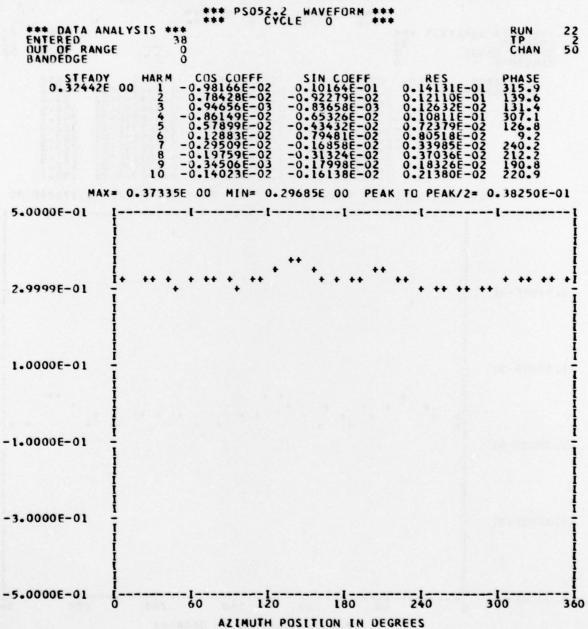
AZIMUTH POSITION IN DEGREES

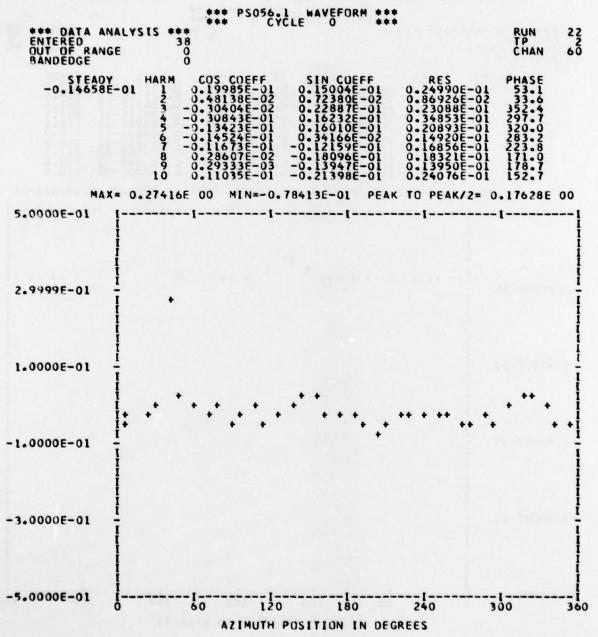
300

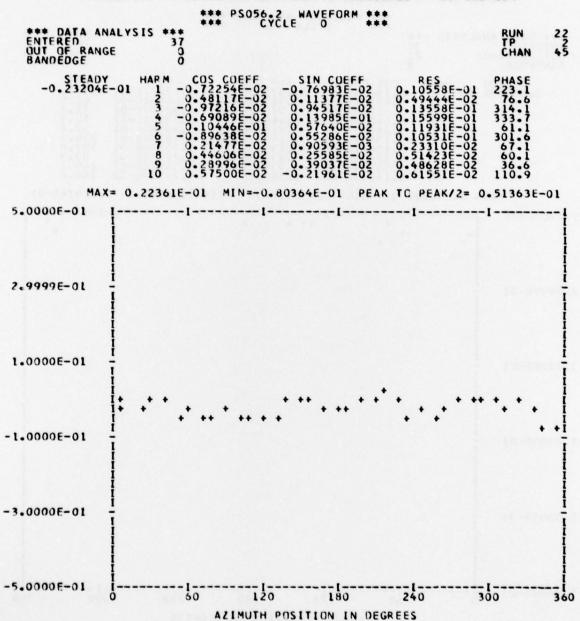
60

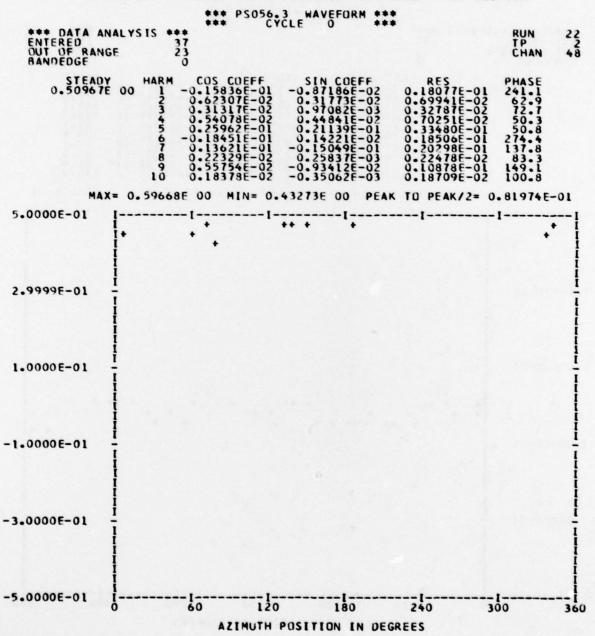
-3.0000E-01

-5.0000E-01



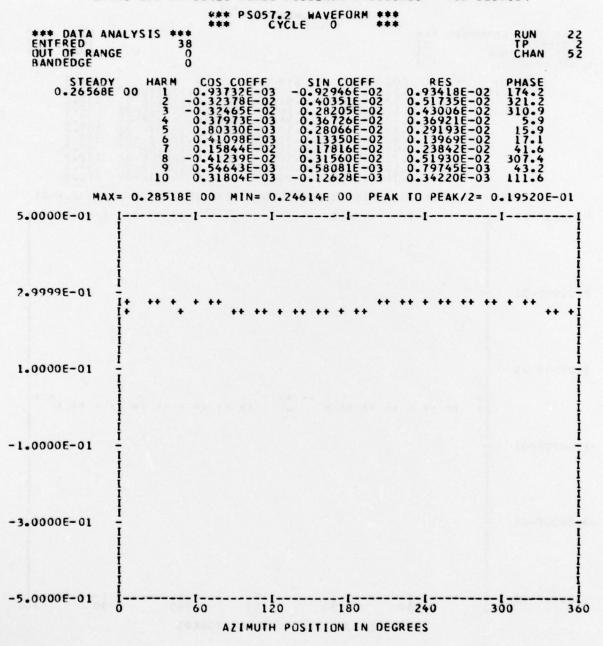






		*** P	5057.1	WAVEFORM .	**	32011011	
*** DATA AND ENTERED OUT OF RANGE BANDEDGE	1	18 0	CYCL		214 313 24 313	RUN TP CHAN	22 55
ST EADY 0.24 190E-	HARM 1 2 3 4 5 6 7 8 9 10	COS CO -0.11081 0.82180 0.12847 0.33174 0.33227 -0.92376 0.99764 -0.72137 0.68059 -0.71941	E-02 E-02 - E-03 - E-03 - E-03 - E-03 - E-03 -	SIN CUEFF 0.20190E-02 0.82893E-02 0.16544E-02 0.56076E-02 0.10198E-02 0.11582E-03 0.11582E-02 0.18506E-02 0.84128E-03	0.11672E- 0.20947E- 0.56845E- 0.34757E- 0.12602E- 0.15286E- 0.18520E-	01 135.2 02 37.8 02 170.5 02 107.0 02 227.1 02 40.7 02 182.2 02 38.9	
MAX= 5.0000E-01				475E-01 PE	AK TO PEAK/2	= 0.18822F	-01
2.9999E-01	40.00						
1.0000E-01	•					10-30	
1.0000E-01	• •• ••	• • ••	•• •	•• •	• •• • ••	•••••	
3.0000E-01							1
5.0000E-01		-[I 021	I 180	<u>1</u>	<u>1</u>	i 360

AZIMUTH POSITION IN DEGREES



*** PSO71.1 WAVEFORM ***

*** DATA ANALYSIS ***
ENTERED 37
OUT OF RANGE 0
BANDEDGE 3
HARMONIC ANALYSIS SKIPPED

